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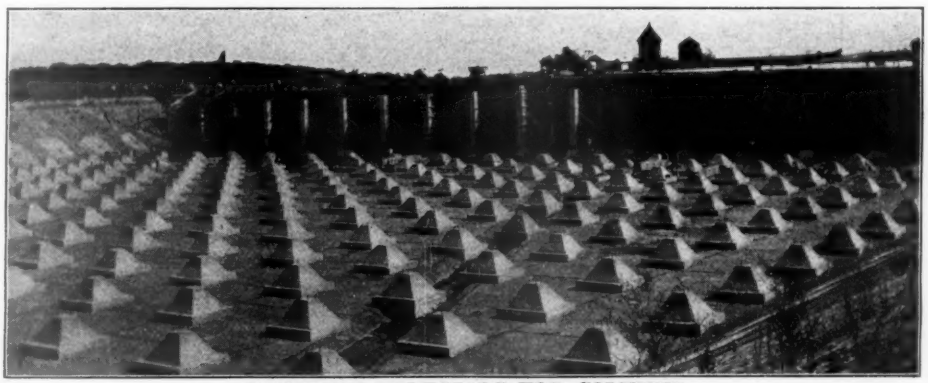

CONCRETE PEDESTALS FOR COLUMNS.
Minneapolis Water Purification Plant.

VOL. XLIII. DECEMBER, 1912. No. 6.

All works of quality must bear a price in proportion to the skill, time, expense and risk attending their invention and manufacture. Those things called dear are, when justly estimated, the cheapest; they are attended with much less profit to the artist than those which everybody calls cheap.

A composition for cheapness and not for excellence of workmanship is the most frequent and certain cause of the rapid decay and entire destruction of arts and manufactures. *Ruskin.*

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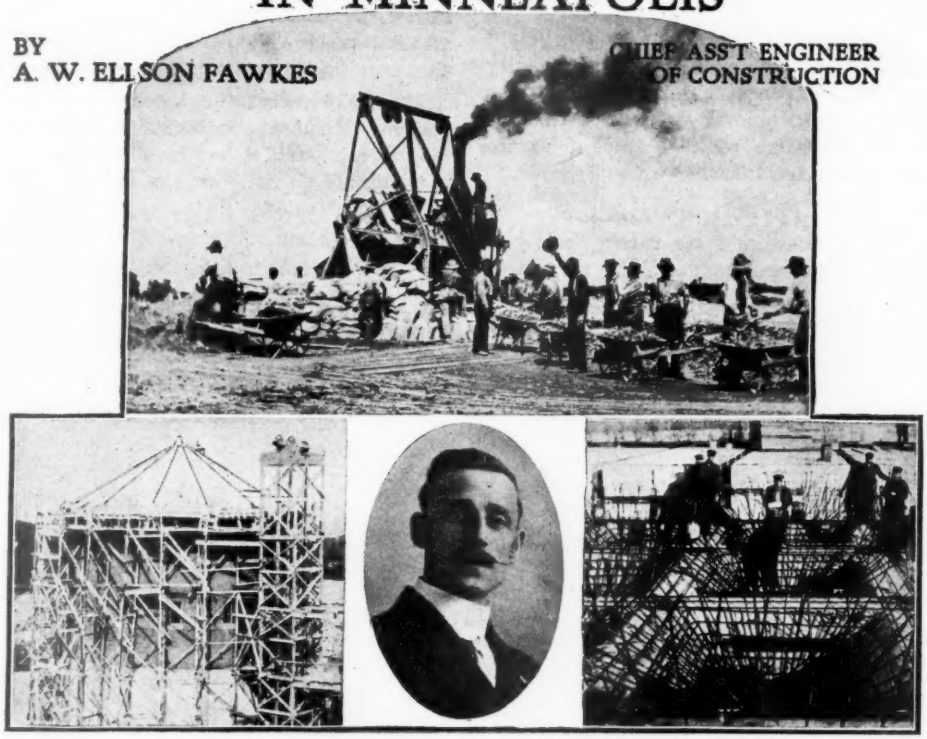
WATER FILTRATION IN MINNEAPOLIS

Filters During Construction—Looking North.

WATER FILTRATION
IN MINNEAPOLIS

BY
A. W. ELLISON FAWKES
CHIEF ASS'T ENGINEER
OF CONSTRUCTION



FOR some years there has been a keen contention in Minneapolis for a pure water supply, and in the early part of 1910 two definite schemes were before the council; viz., mechanical filtration and the piping of water from Mille Lacs, a distance of eighty-one miles. The vital points were, pure water, quantity, character of project and cost. The present average consumption of water in Minneapolis is twenty million gallons daily with a population of 316,000, a per capita consumption of sixty gallons per day. Quite a low figure at a glance, but a study of the analyses of the Mississippi water is explanatory. On account of the evaporation, run-off and shrinkage of the water on Mille Lacs, also the estimated cost of $3,913,414, approximately $48,915 per mile, the Mille Lacs scheme was abandoned in favor of the mechanical filtration scheme, by this means utilizing the existing pumping stations with an increased pumping capacity of 80,000,000 gallons per day. The mechanical filtration system having been decided upon, various analyses of the water were taken to determine the extent of the mechanical scheme. Briefly, the water of the Mississippi was analyzed for the following elements:

Chemical Analyses (sanitary)—Free ammonia, chlorine, alkalinity, hardness.

Physical Analyses—Suspended matter, (a) mineral, (b) organic; rate of sedimentation, color, suspended and dissolved, (a) organic, (b) inorganic.

Biological Analyses—Bacteria, plankton.

Mud Analyses—Mineral, clay, silica, organic (dead and living).

Chemical Analyses

Free albuminoid and ammonia varies from .430 in May to as low as .059 in October.

The average total hardness reaches a maximum of 173 and a minimum of 139. The maximum is during the months of December, January, February. The minimum is during April.

Chlorides vary greatly with the height of water, and follow directly the alkalinity and total hardness. During the past ten months the chlorides have varied in about the same relative amount as the permanent hardness.

Physical Analyses

The Mississippi river varies greatly in color at different points along its course. These changes in color are caused by the confluence of tributary streams. Along some of the highly-colored tributaries are large swamps, the water of which shows a color as high as 700 to 800. This color is derived from macerated vegetable matter, and persists as a considerable factor in the total color of the Mississippi at Minneapolis. The greatest reduction of color occurs during the months of August and September, and there is very little in the winter. This is coincident with the greatest and least amount of plankton. When copper-sulphate was used to destroy plankton the bleaching process at the reservoirs was interfered with.

The organic residues are greater in the summer months. The inorganic residues follow the alkalinity and chlorides. The mineral residue varies from 113 to 162. The organic from 62 to 75.

The turbidity of the Mississippi river water at Minneapolis is usually low, so low, in fact, that it has been regarded as a negligible quantity in the earlier analyses. In occasional instances it has for a short time risen to 25 or 30, but quickly subsides. It is safe to assume that in 350 days of the year it is in the neighborhood of 10.

WATER FILTRATION IN MINNEAPOLIS

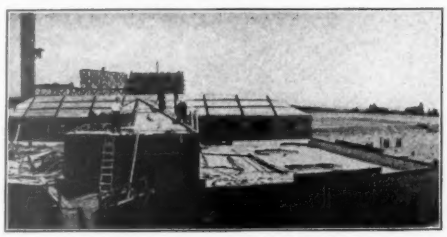
I. Top of Filters Showing Walk Ways and Forms for Roof Columns, Under Construction.

The Mississippi water deposits on an average .13 cubic yards of sediment per million gallons of water during the period of a four-days' sedimentation. In the process of sedimentation, the algae and diatoms are the first to be deposited; at the end of twenty-four hours, only fine clay remains suspended in water, and at the end of ninety-six hours but 36 per cent. of the original turbidity remains. The following is an analysis of deposited matter taken from the city reservoir recently:

Organic matter.....	19.3%
Alumina	13.6%
Silica	50.3%
Iron (ferric-oxide).....	6.5%

Biological Analyses

The most objectional feature of the Mississippi river water at Minneapolis is the bacterial content. Colon bacilli are constantly found in the water. This indicates the presence of animal contamination. The high rate of typhoid fever in Minneapolis among the users of the river water of the Mississippi goes to prove this. The fact that the typhoid bacillus has been isolated from the waters of the Mississippi at Minneapolis, and the fact that above Minneapolis are situated several large towns contributing sewage directly into the river, indicates the dangerous character of the raw Mississippi river water. It is a fact that typhoid fever germs will live in the same water for ten days. The Mississippi water passes several towns, such as Grand Rapids, Anoka, St. Cloud, Little Falls and Brainerd. The water that passes these towns reaches Minneapolis in less than eight days. The contamination of the Mississippi at Brainerd is sufficient to give colon bacilli in every centimetre of the water throughout the course of the stream as far as Minneapolis. The absolute numbers of bacteria in the water at Minneapolis vary according to the season; the greatest in July and August, 3,000 per c. c., and lowest in January, 150 per c. c.

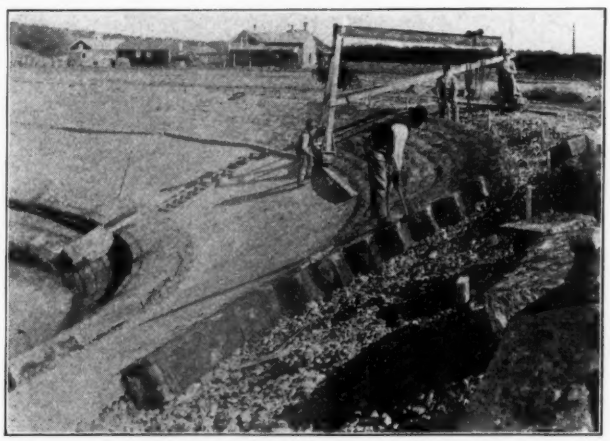


WATER FILTRATION IN MINNEAPOLIS
II. Forms of Concrete Roof of Transept Arch of Filters.

The greatest percentage of reaction occurs in the reservoirs also during the months of July and August. These are the months of the maximum of plankton, when the range is from 400 to 1,200; in January 75 is an average.

Constructional Layout

The satisfactory purification of the Mississippi river water at Minneapolis requires the accomplishment of two objects: First, the elimination of the pathogenic bacteria, and second, the removal of turbidity and color, so as to render the water palatable and attractive in appearance. Mechanical filtration and sterilization were selected as the best means of securing the desired results. The problem of purification of the Mississippi water having been solved, and the amount and kind of purifying mediums to be administered having been determined, the constructional part of the scheme started late in the fall of 1910, and has progressed very rapidly, the work being done on the day labor plan, the city of Minneapolis being the contractors.



WATER FILTRATION IN MINNEAPOLIS
III. Increasing Height of Settling Basin.

The layout is as follows: The raw water is pumped into the south reservoir, which will act as a settling basin. After sedimentation it passes thru a 60-inch c. i. pipe into the controlling chamber, where the volume is measured by a venturi

IV. Form Work for Groined Arch Covering Over Clear Water Basin, Showing Pedestals and Column Forms.

meter situated near the floor of the controlling chamber and is entirely submerged when the plant is in service. Under ordinary conditions the water flowing out at the end of the meter enters the mixing chamber, where the purifying mediums are introduced. The construction at this point is such that, if for any reason it is necessary to by-pass this mixing chamber, the water can be passed thru a 42-inch by 60-inch gate into the lower portion of the center passage and thence into the coagulation basins, or thru the upper portion of the center passage directly into the filters, thus cutting out both the coagulation basins. The water is carried into the filters thru a 60-inch pipe from the end of the center passage with branches at each filter. The water passes thru a 30-inch bed of sand and an 8-inch bed of gravel into the two clear-water basins situated below the filters, and thence into the clear-water storage reservoir, or directly into the city distributing mains to the city.

South Reservoir or Settling Basin

This basin is of concrete construction to within ten feet of the top, this space being filled with lining stones with a 4-foot coping which supports an ornamental railing enclosing the reservoir. The original capacity of this reservoir was 47,000,000 gallons, but to overcome and provide a working head for the filter system, this basin was raised another ten feet, thus making a storage capacity of 75,000,000 gallons. This is shown in progress in Plate III. The water is pumped into this reservoir for a distance of about four miles thru a 50-inch steel main.

Venturi Meter

This meter is of concrete with a cast iron throat 30 inches in diameter, increased to 60 inches at the ends. Brass tubes are connected with the throat of this meter that are connected to the registering meter in the head house which records the flowage.

Mixing Chamber

The mixing chamber is of reinforced concrete construction, 35 feet wide, 175 feet long and 17 feet deep. Inside wooden baffles of round-the-end type, spaced three feet apart, deflect the water back and forth across the width of this chamber, thus causing a thorough mix of the coagulant solutions with the water. There are four gates in this chamber for drawing off the water into the center passage, as condition requires. The roof to this chamber is of concrete on the T-beam construction principle, with a top covering of earth two feet thick.

Coagulating Basins

The coagulating basins are two in number, each measuring 96 feet by 120 feet. They are of reinforced concrete construction, the roof being of the T-beam construction supported by 126 concrete columns. Concrete baffles are placed the long way of the basins to give the desired effect, as in the mixing chamber. These basins are two separate units to facilitate the cleaning out of the precipitate and other matter. This is accomplished by a 20-inch flushing line. The floor of basins being on a 1 per cent. grade, this matter is carried to the drains in connection with the sewer, which is situated along the east side of these chambers.

Center Passage

The center passage is of concrete situated between the mixing chamber and the coagulating basins, and runs the whole length of these basins. This center passage consists of two compartments, the water passing thru the lower compartment into the coagulation basins and over skimming weirs into the upper section from the same source, thence into the 60-inch influent pipe to the filters.

Mechanical Filters

The mechanical filters are twelve in number, situated either side of the pipe gallery. These filters are of reinforced concrete and were poured monolithic, except the lateral gutters, which were poured at a later date. Each filter is divided into two sections, 52 feet by 11 feet 6 inches, with a central wash-water gutter, 2 feet 6 inches wide, to which are connected the eight lateral gutters. The top portions of the filters are laid out with walkways. The tops of filters are shown in Plate I, and the groined arch forms for the floors in Plate V. Each filter is designed to filter normally 3,250,000 gallons daily, giving a total capacity

of 39,000,000 gallons. The rate of filtration with 360 square feet of filtration surface per million gallons of daily capacity will be 125,000,000 gallons per acre daily. These filters are capable of carrying an overload from 25 to 50 per cent. for short periods.

The washing of the filters is accomplished by back-flushing with filtered water at a high rate of about 15 gallons of wash water per minute per square foot of sand area.

Ridges of concrete spaced one-foot centers run in parallel lines across the filters, 13 inches high. A strainer plate takes a bearing five inches up on these ridges, thus forming a water course beneath the filter gravel. These strainer plates are of bronze, perforated with holes 1-32 of an inch in diameter, and also support the four grades of gravel that come flush with the top of the ridges. Over the top of these ridges and gravel is placed a wire screen securely anchored down to the ridges by ¼-inch brass bolts. A layer of sand 30 inches deep is placed above this wire screen.

WATER FILTRATION IN MINNEAPOLIS
V. Groined Arch Forms and Specials for Floor of North Range of Filters.

Wash Water Tower

The wash water tower is circular in construction, 46 feet in diameter, built of concrete from grade 296 to grade 369. Elevation 296 to 340 is for storage rooms, and elevation 340 to 353 is a concrete storage tank of 135,000 gallons capacity. The outside of the tower from grade 327 is faced with red brick work. This wash water tower is for the purpose of water storage, with sufficient pressure for an upward wash to the filters. This tower is shown in the left-hand cut on the title page of this article.

Filtering Mediums

The filtering mediums consist of four grades of gravel and one grade of sand. The bottom layer of gravel is three inches thick, composed of pebbles. These pebbles pass thru a screen of one-inch mesh, and are retained on a screen of ⅝-inch mesh. The second layer is two inches thick. The grains pass thru a screen of ⅝-inch mesh and are retained on a screen of ⅜-inch mesh. The third layer is 1¾ inches thick, passing thru a screen of ⅜-inch mesh and retained on a screen of 5/16-inch mesh. The top layer is 1¼ inches thick, passing thru a screen of 5/16-inch mesh and retained on a screen of No. 20 wire having ten meshes per lineal inch. This gravel is of hard and durable rounded particles, with a high specific gravity, free from thin or flat pieces, washed and screened, and free from sand, loam, dirt and organic impurities. This gravel, without being ground or crushed, is digested for twenty-four hours in cold, strong hydrochloric acid, and 95 per cent. remains insoluble.

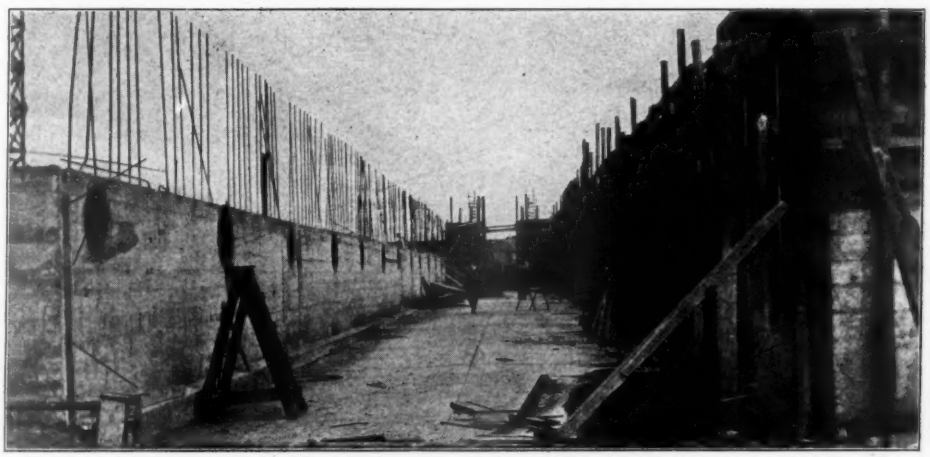
The filter sand is placed above the gravel separated by a wire screen to a depth of 30 inches, and is of a hard and durable kind, free from clay, loam, organic matter and flat particles and stands up to a similar test to the gravel above. This sand has an effective size of not less than .35 nor more than .44 of a millimeter, and a uniformity coefficient of not more than 1.65. Not more than 1 per cent. is finer than .25 of a millimeter and 90 per cent. is finer than .8 of a millimeter. The diameter of the sand grains is computed on the spheres of equal volumes, and all percentages are calculated by weight.

Pipe and Operating Galleries

The pipe gallery situated between the filters is 18 feet wide and contains the influent pipe, wash water pipe, hydraulic

valves, ¼ h.p. motors in connection with the sample pumps, float tubes and simplex controllers. There is a sewer running thru the length of the pipe gallery, into which the wash water from the filters is carried. A principal feature of this pipe gallery is the free and clear passageway from end to end. This was accomplished by suspending the 60-inch influent pipe from I-beams under the operating floor, the wash water pipe being suspended from the influent pipe in a similar manner. It is shown under construction in Plate VI.

The operating gallery is situated above the pipe gallery and on a level with the walkways to the filters, in which are situated the twelve operating tables which control the hydraulic valves in the pipe gallery below, and motors to the sample pumps. The head gage and loss-of-head gages are situated on these operating tables, and are of the rotary chart type, the pens being connected with the floats in the respective float tubes, so that at a glance the chart can be read as to the head of water, also when the filter requires washing, the pen having reached a predetermined line on the chart. The scale beams that control the simplex controllers are situated on this floor, in line with the operating tables.



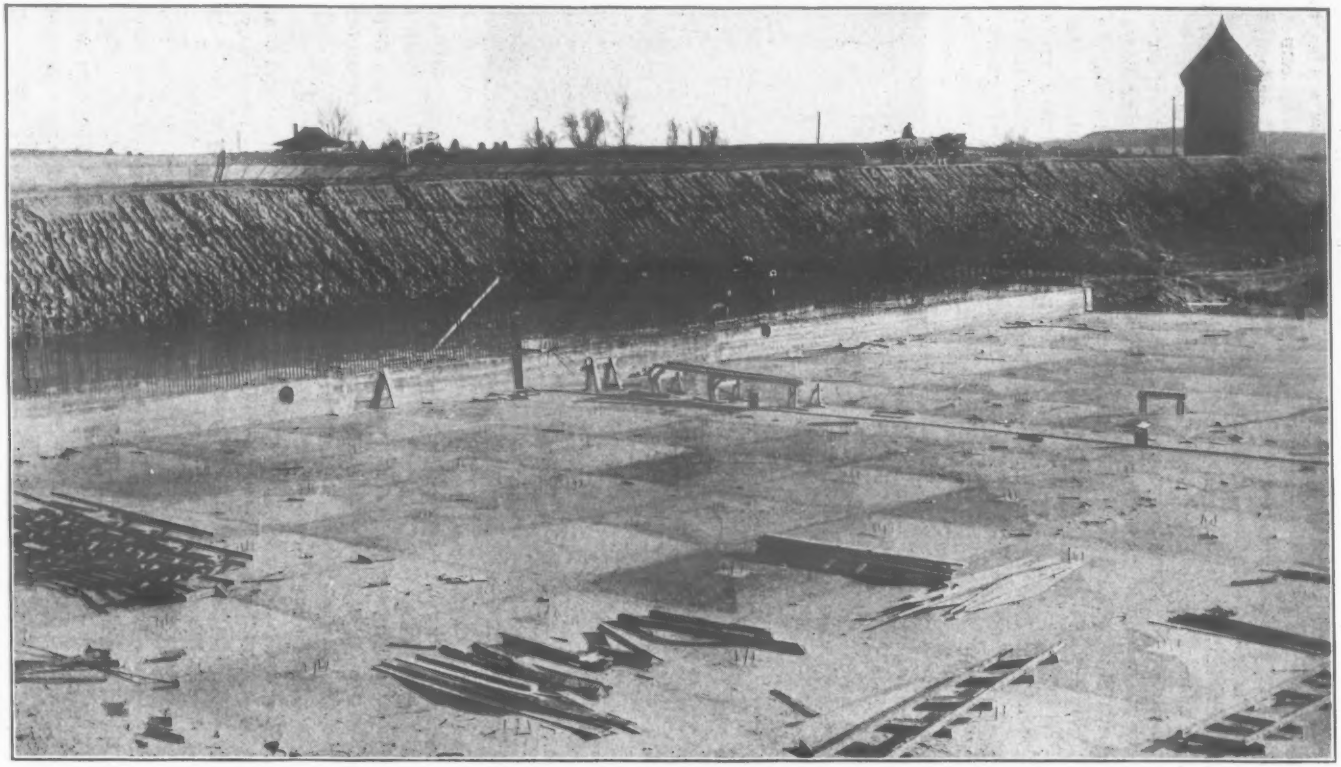
WATER FILTRATION IN MINNEAPOLIS
VI. Pipe Gallery Between Filters, Under Construction.

Clear Water Basin or Storage Reservoir

The clear water storage basin is a large concrete tank, 880 feet long, 440 feet wide and about an average depth of 24 feet. This basin is covered with a concrete groined arch roof supported by 960 20-inch columns at 19-foot centers. These columns are supported on pedestal bases, 7 feet by 7 feet at base to 20 inches at the top. The floor and roof under construction are shown in Plate IV.

The method of construction was as follows: The whole of the pedestals were poured first, next followed the columns in the following manner: The forms to the groined arches were made in four sections in such a manner that they could be dropped and carried forward, and they were used about ten times. The column forms were constructed in a like manner; i. e., a sufficient number of forms were made for the groined arches and columns to complete 120 sections. The column forms were first erected and braced, these forms supporting the noses of the groined arch forms. Center or table posts with 4x6-inch stringers supported the other portion of the groined arch forms. The concrete was mixed in a one-yard mixer, shown in the title, and dumped into dump cars, and these cars were hauled over a temporary track placed between the centers of the columns on the groined arch forms, thus enabling the pouring of the concrete to the columns and the concrete to the groined arches without hav-

WATER FILTRATION IN MINNEAPOLIS



Bottom of Coagulation Basin and Embankment of Settling Basin.

ing to move the track. It was thought advisable to pour the concrete to the columns a day ahead of the groined arches, and this system was carried out until the completion of the roof. The forms to the groined arches were dropped in about ten days and carried forward and placed in position ahead, so that there were always three rows of forms ahead of the concrete. The cost of these groined arch forms was $20 per set of four, which, at a glance, appears high, but after being used ten times the cost came out at about 2 cents per square foot. During the construction of this concrete roof no fracture of any kind took place. An extensometer was used to take the deflection of the concrete arches with a moving load of about 5,000 pounds. This gave a deflection of about .06 of an inch. The total amount of concrete in this roof is 15,000 cubic yards. The mixture used was 1 part cement, 2 parts sand, 4 parts broken stone. The following is a fair average of cost, being the medium of a near and far haul:

Cement	$2.00
Crushed stone	1.35
Sand	.28
Mixing, transportation, placing	.82
Form building, 2c a square foot	.10
Wrecking and placing forms	1.40
Total per cubic yard	$5.95

The concrete roof was covered with about 24 inches of earth at a cost of 45 cents per cubic yard. The first start to pour the concrete to this roof was June 2, 1911. The last arch was poured on October 28, 1911. The earth fill was completed on December 2, 1911. The approximate amount of fill or covering was 52,000 cubic yards.

Head House and Filter Building

The filter building is situated on and covers the whole of the filters and operating gallery, the roof being of cinder concrete, built in the form of a transept arch, and joining the roof of the head house. This building from grade 327 is of red brick facing with sand-lime inside the building. The head house is of concrete construction from grade 298 to 328, and consists of various operating floors, in which are placed the various devices in connection with the operation of the plant. At floor 300 are situated the two large centrifugal wash water pumps with an 8-inch discharge, having a capacity of 1,800 gallons per minute against a 50-foot head. This water is taken from the clear water basins and pumped into the tower. These pumps are intermittent in action, and each is controlled by an electrical apparatus which will automatically stop it when the water reaches a certain elevation in the wash water tank. These pumps are driven by two 40 h.p. motors. The bases of the hypo, alum and lime tanks are at this elevation. Plate II shows location of these buildings and roof under construction.

Appurtenances

The alum tanks are of concrete construction, reinforced with ¾-inch steel rods, both vertically and longitudinally. They are 12 feet by 13 feet by 12 feet high. The concrete to these tanks was put in to a 1-2-4 mix at a cost of about $7 per cubic yard. Above these tanks are situated 3-h.p. motors to drive the agitating device, which consists of a propeller blade at the end of a shaft at the bottom of the tank, to keep the chemicals in motion. There are two pumps in connection with these alum tanks of the single suction type, with 2-inch discharge, having a pumping capacity of 40 gallons per minute against a 45-foot head, including friction. They are operated by two single 2-h.p. motors. These pumps have bronze shells, runners and diffusion vanes and monal metal shafts with especially designed packing to resist the action of the acid solutions.

The hypo tanks are similar to the alum tanks, except that they have a concrete cover over them.

The lime tanks are of steel plate construction, three in number, 12 feet 6 inches in diameter and 13 feet high, with an agitating device and pumps of like capacity.

There are a lime crusher and two lime mixers, and a trolley for conveying the various chemicals to their respective mixers.

Flushing pumps of the two-stage, 50-h.p. centrifugal type, capacity, 500 gallons per minute against 100 pounds pressure; pressure pumps discharging 30 gallons per minute against an 80-foot head, started

and stopped by means of floats operating Cutler-Hamer series relay self-starters; twelve sample pumps, capacity of two gallons per minute against a 20-foot head; a sump pump of the vertical submerged type with capacity of 200 gallons per minute against a 15-foot head and a suction of six feet, are required in the operation of the control.

Storage bins are of concrete heavily reinforced with steel and were poured monolithic at a cost of $9 per cubic yard. They are twelve in number and are 10 feet by 10 feet by 18 feet deep, with a spout at the lower end to deposit the various chemicals into movable buckets. Their purpose is for the storage of alum, lime and hypochlorite. Their reinforcement is shown in the right-hand cut on the title page.

Chemical feed tanks are also of concrete, two each for lime, hypochlorite and alum.

The handling of the chemicals has been worked out in a very comprehensive manner to minimize the cost. The head house is constructed with two side entrances for the purpose of enabling the teams to dump their loads down chutes to the chemical chamber below, in which are two 10-inch pipes, one leading to the crusher for the lime, the other leading to a bucket elevator. A chute also leads from the bottom of the crusher, so that the lime is conveyed to the bucket elevator, which takes this material to the top of the tower and dumps it into a hopper connected with an extension spout that will reach to all the storage bins. The chemicals pass out at spouts at the bottoms of the bins into buckets attached to scale dials and then travel along a trolley track to their respective chemical solution tanks.

A fill is placed around the head house, filter building, wash water tower, coagulating and mixing chambers with one to one and one-half slope with a six-foot crown, from grade 304 to 321. This embankment is a precautionary measure to prevent the water freezing in winter.

Quantities

The quantities are approximately as follows:

35,000 cubic yards of concrete.
100,000 cubic yards of excavation.
250,000 cubic yards of fill and embankments.
600 tons of reinforcing and structural steel.

Design and Supervision

The plant was designed by Hering & Fuller, consulting engineers, New York. The whole of the constructional work was done by the city of Minneapolis on the day labor plan, under the supervision of W. N. Jones, filtration engineer; A. W. Ellson Fawkes, chief assistant engineer of construction, and water works engineer Arthur Jensen.

The completion of this work is six months ahead of the time that the city had dared to hope for pure water, also the work has been executed $70,000 below the estimated cost. From the general tone of all concerned, this work has been a decided municipal success. The cost of the project is one and one-half million dollars.

MR. A. W. ELLSON FAWKES, chief assistant engineer of construction for the city of Minneapolis, Minn., on the construction of its mammoth filtration plant, now nearing completion, has had an experience which amply fitted him for his position. Born a British subject, he began his training with Chivers & Sons, engineers and contractors, Devizes, England, passing thru the carpentry, brickwork, masonry and general construction departments in six years. He kept up his technical studies, and is a graduate of Heriot-Watt College and the College of Science and Technology, Edinburg, both in Scotland.

His professional engagements have included work as assistant engineer for the British Government in construction of bridges, forts, etc., in Scotland and for Vickers' Sons and Maxims, England, where the work controlled amounted to $1,600,000; as engineer on the Derwent Valley water scheme in England; as chief engineer of dam and electrical power development at Middle Falls, Ontario, Can.; of the city of Peterborough, Ont., in construction of concrete dam and pumping station on the Otonabee river, which was completed nine months ahead of contract time. He has also been consulting engineer for the town of Millbrook, Can., and engineer on concrete bridge construction for the Chicago, Milwaukee and St. Paul Railway.

His professional standing is further atttested by his position as a member of the Institution of Civil Engineers of England.

THE USE OF CONCRETE IN SEWERS.

THE design of concrete sewers has not yet been reduced to standard practice, and a comparison of a few designs may be of interest as showing the tendencies and the variations made by engineers working independently and with their special conditions in mind. The accompanying Table I shows the dimensions used in designs of the larger sizes of sewers in several cities, and contains quite a full set of standards for sewers from 2 feet to 8 feet in diameter and their equivalents in other sections than circular, from Portland, Ore. These standards cover both plain and reinforced concrete, and in form of cross-section and other dimensions cover the requirements of most conditions to be met.

Standards in Portland, Ore.

The general features of the design used in Portland, Ore., for plain concrete sewers are shown in Fig. 1, which is a sectional drawing of a 24-inch sewer. The

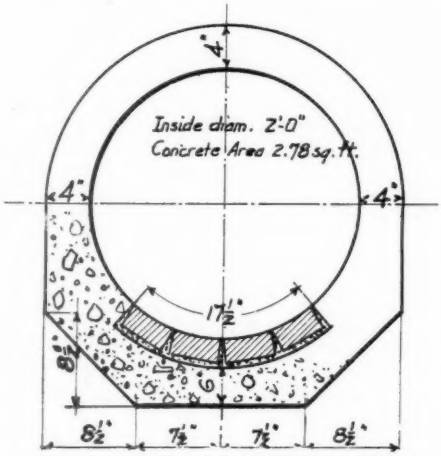


FIG. I. PLAIN CONCRETE SEWER, PORTLAND, ORE.

arch ring is of uniform thickness. The bearing of the concrete on the bottom of the trench is in plane surfaces, with some excess of concrete on account thereof and some additional thickness at the bottom. Part of this additional thickness is occupied in some of the standard designs by vitrified brick paving, which, in the 24-inch size, has the bricks laid on their sides. Other designs for larger sizes have the bricks set on edge, have stone blocks, or 1 inch of cement plaster, or have no lining, the plain concrete surface taking the wear.

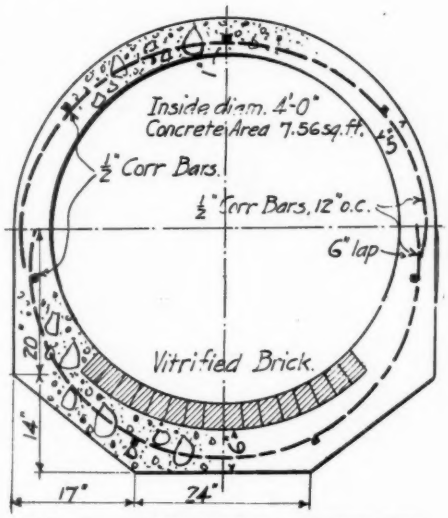


FIG. 2. REINFORCED CONCRETE, PORTLAND, ORE.

The table gives the details of the standard series of designs on file, and they are variable as to these and other details according to requirements of grade, volume, velocity, character of drainage, etc.

The thicknesses shown in the table are those shown in the figures at crown, springing line and bottom; the character of the lining over the lower part of the section is stated in one column, a blank indicating that no lining is required. The width of the lining is shown in another column and shows the judgment of the engineer as to the area subject to specially hard wear on account of rough and heavy materials rolled or pushed along the sewer invert by the flow of the sewage or storm water.

Some of the Portland designs show a horizontal bearing on the bottom of the

trench, which has a width nearly equal to the diameter, and the sides are brought up on straight lines tangent to the outside circle of the section. This would require a form for the outside of the bottom, which has circular arcs for a short distance below the springing line, but probably approximates quite as near-

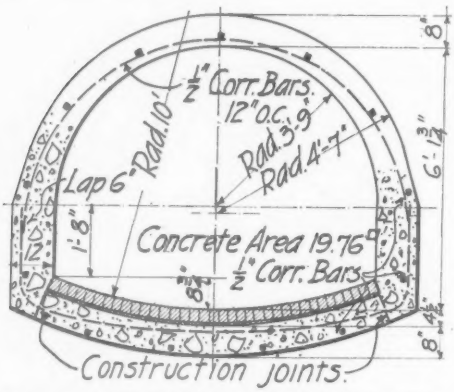


FIG. 3. REINFORCED CONCRETE SEWER, PORTLAND, ORE.

ly to the surface of the trench bottom, no form being used for the outside of the bottom, as the design shown in Fig. 1. The lined 24, 30 and 72-inch sewers are similar to Fig. 1 in cross-section. The unlined or 30 and 39-inch sections and the cement-plaster lined 33-inch section are modified as described.

Plain concrete is also used in sections of sewer in tunnel. These sections are similar in form to that shown in Fig. 3. The invert is of concrete 8 inches thick, with an additional paving of stone blocks 5 inches thick. It is laid on a circular arc of 8 feet radius and a span of 6 feet. The side walls are of concrete, 12 inches thick, and of height required for the conditions, approximately 2½ feet. The arch is semi-circular, 1 foot thick at the springing line and 10 inches thick at the crown, the inside radius 3 feet and the outside 4 feet, with its center down 2 inches to give the proper crown thickness.

The general design of reinforced concrete sections is shown in Fig. 2, dimensions varying with sizes as shown in the table. Sections A, B and C vary mainly in amount of reinforcement, as shown in the table, Section C being the one shown in Fig. 3. The 60, 78 and 96-inch sewers have the modified bearing on the bottom of the trench above described. The character of lining is shown in table I.

The prices given in the last column are the contract prices paid for construction.

Plain Concrete in Kalamazoo

The design of plain concrete sewer used in Kalamazoo, Mich., is shown in Fig. 4, with dimensions. The cost of the 33-inch section shown is proportional to that of $1 per foot for 30-inch and $1.75 for 40-inch sewers of similar section.

Outfall Sewer in Rochester

The 7-foot section of the outfall sewer at Rochester, N. Y., is shown in Fig. 5. A design for the 8-foot section is similar, except that a hollow invert block is used and the 8-inch drain pipe is omitted. The dimensions are given in the table. The entire sewer is lined with a course of brick, the lower third being selected extra hard burned or vitrified brick.

Sections for Special Services

A design for a concrete sewer used in Albany, N. Y., for a special service in a stream bed is shown in Fig. 6. It is of plain concrete, with one exception, and the general dimensions vary as shown in

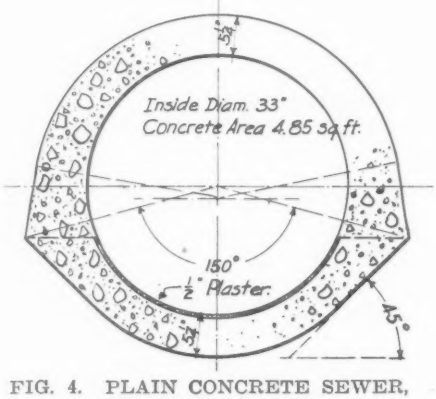


FIG. 4. PLAIN CONCRETE SEWER, KALAMAZOO, MICH.

the table, the equivalent circular sewers for the four sections listed being 57, 54, 45 and 39 inches, respectively. The only reinforcement used is in the form of

TABLE I.

Elements of Designs of Concrete Sewers.

Diam. in.	Thickness Crown in.	Thickness Spring in.	Thickness Bottom in.	Reinforcement lbs. bars per lin. ft.	Bottom Lining of	Width of Lining in.	Area of Concrete Section sq. ft.	Cost per lin. ft.
PORTLAND, ORE., PLAIN CONCRETE.								
24	4	4	6	.....	Brick	17½	2.78	1.50
30	5	5	5	.....	.....	....	4.13	2.00
30	5	5	9	.....	Brick	24	4.59	2.00
33	5	6	6	.....	Cem. Plas.	27	5.40	2.50
39	6	6	6	.....	.....	....	6.34	2.75
72	12	12	12	.....	Stone	56½	26.19	11.05
72x72*	12	12	13	.....	Stone	72	21.09	9.38
72x71*	10	12	13	.....	Stone	72	20.98	9.00
PORTLAND, ORE., REINFORCED CONCRETE.								
48	5	5	10	19.7	Brick	39	7.56	4.36
60	6	7	7	27.2	Cem. Plas.	47	10.80	5.05
72†	8	8	14	42.0	Stone	57	21.06	9.60
78	7	8	8	30.6	Cem. Plas.	61	16.20	7.05
96	9	10	10	38.2	Cem. Plas.	75½	25.38	10.45
A	10	10	12½	38.8	Brick	93	21.69	9.00
B	10	10	12½	36.6	Brick	93	20.92	8.90
C	10	10	12½	35.7	Brick	93	19.76	8.50
KALAMAZOO, MICH.								
40	....	....	....	.....	.....	....	.....	1.75
33	5¼	5¼	5¼	.....	Cement	75	4.85	.....
30	....	....	....	.....	.....	....	.....	1.00
ROCHESTER, N. Y.								
84	12	13	10	.....	Brick	....	.....	.....
96	13	9	9	.....	Brick	....	.....	.....
ALBANY, N. Y.								
51x60 equals 57 in. cir.	8	9	8	0.94	.....	....	16.03	4.03
51x53 equals 54 in. cir.	8	9	8	0.94	.....	....	13.63	3.50
51x40 equals 45 in. cir.	8	9	8	0.94	.....	....	11.50	2.90
51x32 equals 39 in. cir.	8	12	8	0.94	.....	....	10.76	2.71

* Tunnel sections.

† Section on pile foundation with base 7 ft. 4 in. wide. A, B, and C differ in vertical height, being 6 ft. 8¾ in., 7 ft. 1⅜ in., and 6 ft. 1¾ in., respectively.

½-inch twisted steel bars about 10 inches long, set vertically in the junction between side walls and invert. These bars are spaced 18 inches apart along the sewer. The larger sizes of this sewer secure their additional area by extending their side walls vertically. The largest has walls 2 feet 3 inches from junction, with invert to springing line. The thickness of these walls at the springing line is 9 inches and at the junction with the invert is 18 inches.

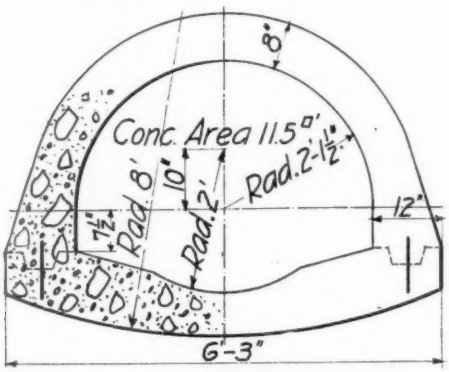


FIG. 6. CONCRETE SEWER WITH SLIGHT REINFORCEMENT, ALBANY, N. Y.

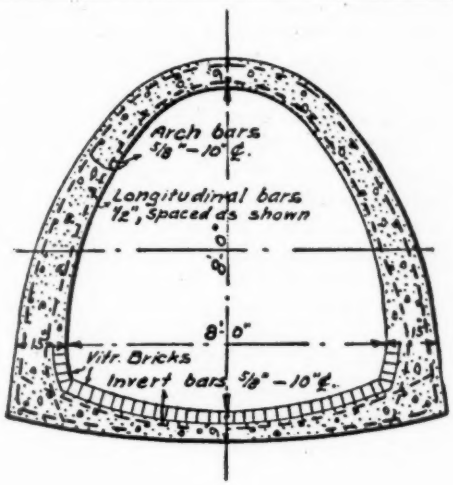


FIG. 9. REINFORCED CONCRETE SEWER, LOUISVILLE, KY.

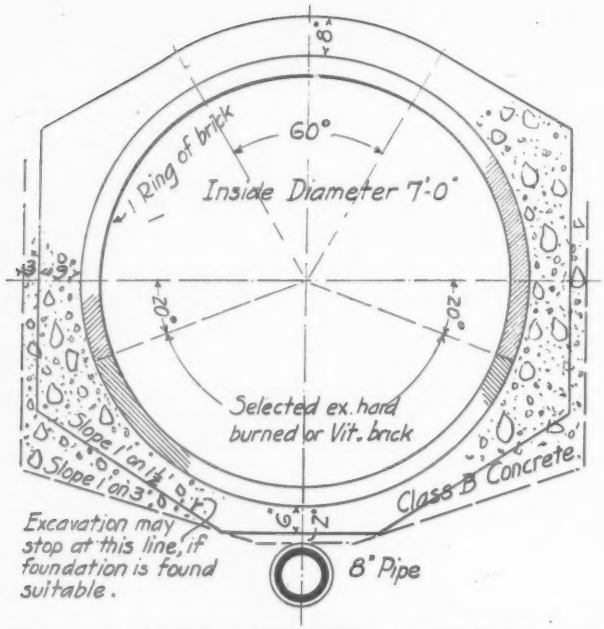


FIG. 5. PLAIN CONCRETE SEWER, ROCHESTER, N. Y.

Figs. 7, 8 and 9 show special designs of reinforced concrete sewers for special purposes, and will serve to indicate the variations which are possible in reinforced concrete designs and the flexibility of the system. Fig. 7 shows a Kansas City sewer under railway tracks and the method of making the arch and its bearings strong enough to carry the weights and the vibrations. Figs. 8 and 9, from Louisville, show outlet drains to take the place of small open streams.

Use of Plain Concrete.

Table II gives some characteristics of practice regarding use of plain concrete in sewers. When the sewer pipe is made in lengths on the surface and is then laid in place in the trench, it is classified as pipe. When the sewer is made in place in the trench it is classified as continuous, no matter how close or how far apart the joints incident to the method of construction may be. In some cases the thickness of the concrete ring and the cost of the sewer are compared with brick and the word "less" in both these columns means that the cost of plain concrete is less than that of brick. The notes following the tables give data which could not be tabulated.

Concrete is used for sewers so generally that no attempt is made to list all the cities using it. Among those using plain concrete generally in sewer construction, not reported in detail in the table, are Phoenix, Ariz.; Monrovia, San Bernardino, Cal.; laid at intervals between 1879 and 1907; Denver, Col.; Bridgeport, Conn.; Decatur, Ill., of 36 to 60 inches diameter; Indianapolis, Plymouth, of 8 to 30 inches diameter, some over twenty years old, Richmond, Wa-

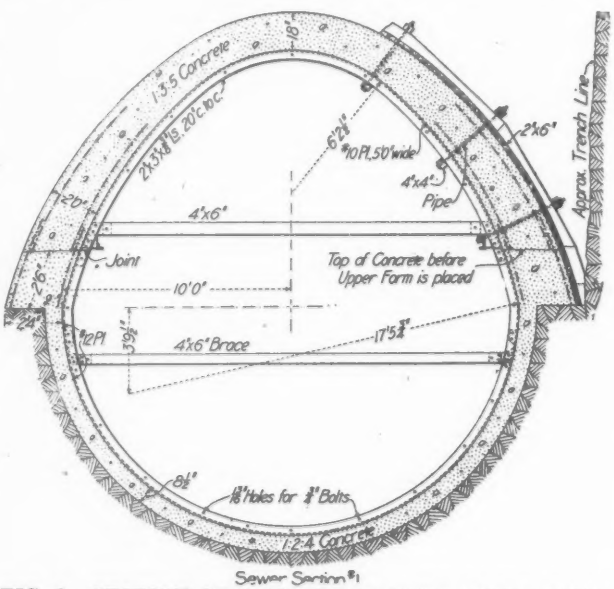


FIG. 7. SECTION OF O. K. CREEK REINFORCED CONCRETE SEWER, KANSAS CITY, MO.

bash, Ind.; Jackson, Mich.; Butte, Mont.; Concord, Dover, N. H.; Newark, N. J.; Buffalo, Richmond boro, Rochester, N. Y.; Cleveland, O.; Muskogee, Okla.; Portland, Ore.; Erie, Philadelphia, Reading, Pa.; Pawtucket, R. I.; Lenox, S. D.; Galveston, Tex.; Seattle, Tacoma, Wash.; Milwaukee, in use thirty years, Oshkosh, laid in '80's, Superior, Wis.

Use of Reinforced Concrete.

Table III gives similar data regarding reinforced concrete for sewers, classified in the same way. Some cities using considerable quantities of reinforced concrete in sewer construction, which did not give full details in responses to requests for information, are Birmingham, using concrete for an 8 by 12-foot outlet sewer, Mobile, Ala.; Los Angeles, Cal., which lines its concrete sewers with brick; Denver, Col.; New Haven, Conn.; Jacksonville, Fla.; Atlanta, Ga.; Waukegan, Ill.; Bremen, Elkhart, Gary, Indianapolis, Wabash, Ind.; Wichita, Kans.; Greenfield, New Bedford, Winchester, Worcester, Mass.; Ford, River Rouge, Wyandotte, Mich.; St. Joseph, St. Louis, Mo.; Asbury Park, Atlantic City, East Orange, N. J.; Albany, Haverstraw, Queens boro, N. Y.; Lorain, Newburg, Toledo, O.; Muskogee, Okla.; Portland, Ore.; Harrisburg, Philadelphia, Siverly, Pa.; Pawtucket, R. I.; Chattanooga, Tenn.; Austin, Houston, Tex.; Richmond, Va.; Spokane, Wash.; Parkersburg, W. Va.; Green Bay, La Crosse, Wis.

TABLE II.

Plain Concrete.

City	Pipe Diam. in.	Continuous Diam. in.	Thickness in.	Cost $ per lin. ft.
Clearing, Ill.— (railroad work.)				
	..	66	..	5.20
	..	63	..	4.41
Savanna, Ill.— (cost of pipe only.)				
	24	..	2	1.00
	18	..	1½	0.65
	12	..	1	0.31
	8	..	¾	0.20
Boone, Ia.— (cost of pipe only.)				
	24	..	2¼	0.50
	22	..	2	0.45
	20	..	1¾	0.40
	18	..	1½	0.35
	16	..	1½	0.25
	15	..	1¼	0.22½
Iowa City, Ia.—				
	18	..	..	0.80
Bay City, Mich.— (cost of pipe only.)				
	36	..	4	0.85
	30	..	4	0.80
Coldwater, Mich.—				
	42	..	6	3.00
	36	..	6	3.18
	24	..	..	2.10
Kalamazoo, Mich.—				
	..	42	..	1.75
	..	30	..	1.00
Kansas City, Mo.—				
	24	..	2	.....
	21	..	2	.....
	18	..	1¾	.....
	15	..	1½	.....
Kansas City, Mo. (Cont'd)—				
	12	..	1¼	.....
	10	..	1	.....
	8	..	⅞	.....
	6	..	¾	.....
South Omaha, Neb.— (Haunches 2 in. to 4 in. thicker over 96 in. diam.) (deep cut.)				
	..	132	13	22.80
	..	126	12	18.88
	..	105	11½	12.50
	..	96	11	15.20
	..	84	10	9.58
	..	78	9½	9.39
	..	78	9½	10.27
	..	72	9	7.75
	..	72	9	8.39
	..	66	9	7.65
	..	54	8	5.37
	..	48	7	4.40
	..	42	6½	3.37
	..	42	6½	4.69
	..	36	6	2.80
	..	30	6	2.70
	..	30	6	3.92
	..	24	4	1.70
Dispatch, N. Y.— (not including trench.)				
	..	12	..	0.10¼
	..	8	..	0.07
Brooklyn Boro, N. Y.— (15 in. and over, egg-shaped.)				
	24	..	2	.....
	18	..	1⅝	.....
	15	..	1⅜	.....
	12	..	1 1-16	.....
	9	..	⅞	.....
	6	..	¾	.....
Cincinnati, O.— (brick.)				
	..	72	9	7.00
	..	72	13	10.00

City	Pipe Diam. in.	Continuous Diam. in.	Thickness in.	Cost $ per lin. ft.
Dayton, O.—				
	..	84	..	6.00
	..	72	..	5.00
	..	60	..	4.00
	..	54	..	3.25
	..	48	..	2.50
	..	42	..	2.00
	..	36	..	1.75
	..	30	..	1.50
Columbia, S. C.—				
	..	48	6	2.93
	..	48	6	4.50
	..	42	..	4.50
	..	36	..	2.44
	..	36	..	3.50
	..	30	..	3.00
Austin, Tex.— (cost of pipe only.)				
	30	..	..	0.55
	24	..	..	0.47
	20	..	..	0.40
	18	..	..	0.35
	15	..	..	0.30
	12	..	..	0.25
Bellingham, Wash.— (cost of pipe only.)				
	20	..	..	0.90
	18	..	..	0.75
	15	..	..	0.60
	12	..	..	0.40
	10	..	..	0.32
	8	..	..	0.22½
	6	..	..	0.16½
	4	..	..	0.11

TABLE III.

Reinforced Concrete.

City	Pipe Diam. in.	Continuous Diam. in.	Thickness in.	Cost $ per lin. ft.
San Francisco, Cal.—				
	..	108	9	25.00
	..	24x36	3	6.00
Wilmington, Del.—				
	48	..	..	1.96
	36	..	..	1.37
	30	..	..	1.06
	24	..	..	0.82
Paris, Ill.— (cost of pipe only.)				
	48	..	4.4	3.60
	44	..	4	2.70
	42	..	3.8	1.90
	36	..	3¼	1.50
	30	..	2.7	1.45
	27	..	2.4	1.00
	24	..	2.2	0.80
	20	..	1.8	0.55
Gary, Ind.—				
	..	72	..	4.07
Mishawaka ,Ind.—				
	42	..	..	5.34
	36	..	..	4.16
	36	..	..	4.25
Richmond, Ind.— (cost of pipe only.)				
	54	..	5	1.35
	48	..	5	1.08
	42	..	4	0.91
	36	..	4	.....
South Bend, Ind —				
	30	..	3½	2.85
	27	..	3	2.65
Sioux City, Ia.— (Second and fourth lines show cost of vitrified pipe sewers.)				
	..	36	..	3.80
	36	..	..	4.29
	..	33	..	2.84
	33	..	..	3.61
Topeka, Kans.— (use 2-rings for brick sewers.)				
	..	60	..	5.04
	..	48	..	3.60
Everett, Mass.—				
	36	..	3	1.70
Grand Rapids, Mich.— (cost of pipe only.)				
	48	..	5	2.65
	30	..	4	1.85
	27	..	3	1.50
	24	..	3	1.00
Jackson, Mich.— (cost of pipe only.)				
	48	..	5	3.00
Kansas City, Mo.— (In column headed "Continuous" is given pounds of reinforcement per square foot of surface area of sewer.) (See Fig. 7 for special section.)				
	84	1.5	8	.....
	78	1.5	7½	.....
	72	1.0	7	.....
	66	0.9	6½	.....
	60	0.8	6	.....
	54	0.8	5½	.....
	48	0.6	5	.....
	42	0.6	4½	.....
	39	0.6	4	.....
	36	0.6	4	.....
	33	0.5	4	.....
	30	0.4	3½	.....
	27	0.3	3½	.....
	24	0.3	3	.....
Billings, Mont.—				
	96	..	6 to 18	19.00
South Omaha, Neb.— (see notes.)				
	..	126	15	32.67
	..	96	11	22.99
Newark, N. J.— (Prices for Parmley block sewers. Continuous also used.)				
	42	..	3½	3.00
	42	..	3½	4.25
	36	..	3	3.76
	27	..	2½	2.60
Plainfield. N. J.— (Parmley block.)				
	33	..	3	3.60
Niagara Falls, N. Y.— (Sewers 20 ft. deep with much rock excavation at $2.50 per cu. yd. Cost of concrete same as brick sewers.)				
	78	..	8	13.50
	72	..	7	12.00
	60	..	6	.....
	48	..	5	.....
	42	..	4½	.....
	36	..	4	.....
	30	..	3½	.....
	24	..	3	.....

City	Pipe Diam. in.	Continuous Diam. in.	Thickness in.	Cost $ per lin. ft.
Watertown, N. Y.—				
(Prices given are for two kinds of reinforced pipe and Parmley block.)				
	36	..	..	8.58
	36	..	..	8.33
	36	..	..	8.09
	33	..	..	5.64
	33	..	..	5.39
	33	..	..	5.20
	30	..	..	3.90
	30	..	..	3.65
	30	..	..	3.60
	27	..	..	2.82
	27	..	..	2.56
	27	..	..	2.53
Chillicothe, O.—				
(cost of pipe only.)				
	30	..	..	1.60
Cincinnati, O.—				
(see notes.)				
	..	96	8 to 14	12.00
Cleveland, O.—				
(Prices on Parmley block, use mainly continuous reinforced concrete) (see note.)				
	39	..	..	2.90
	33	..	..	3.96
	30	..	..	3.49
	27	..	..	2.78
Columbus, O.—				
	36	..	4	2.00
	24	..	3	1.20
Dayton, O.—				
	60	..	8	2.50
	54	..	7	1.98
	48	..	6	1.53
	..	108	12	6.38
Lancaster, O.—				
	60	..	6	2.50
	48	..	5	2.00
	36	..	4	1.95
	30	..	3½	1.85

City	Pipe Diam. in.	Continuous Diam. in.	Thickness in.	Cost $ per lin. ft.
Sandusky, O.—				
	24x36	..	3	1.50
	27	..	2½	1.15
	24	..	2½	1.00
Columbia, S. C.—				
	..	60	less	5.50
	..	42	..	4.00
	..	36	..	3.00
	..	30	..	2.20
Lake City, S. C.—				
	60 to 27	..	..	less
Aberdeen, S. D.—				
(cost of pipe only.)				
	36	..	4	1.75
	24	..	2½	0.80
Knoxville, Tenn.—				
	36	..	4	2.50
Salt Lake City, Utah—				
	40	..	7	3.15
	36	..	6	3.07
	30	..	5	3.80
Seattle, Wash.—				
(Pipe used also.)				
	..	144	..	51.00
	..	42	..	13.00
Charleston, W. Va.—				
(No excav. for 72-in. concrete and brick.)				
	..	72	..	6.16
	..	54	..	8.89
	..	48	..	4.95
Janesville, Wis.—				
(cost of pipe only.)				
	48	..	5	2.00
	36	..	4	1.80

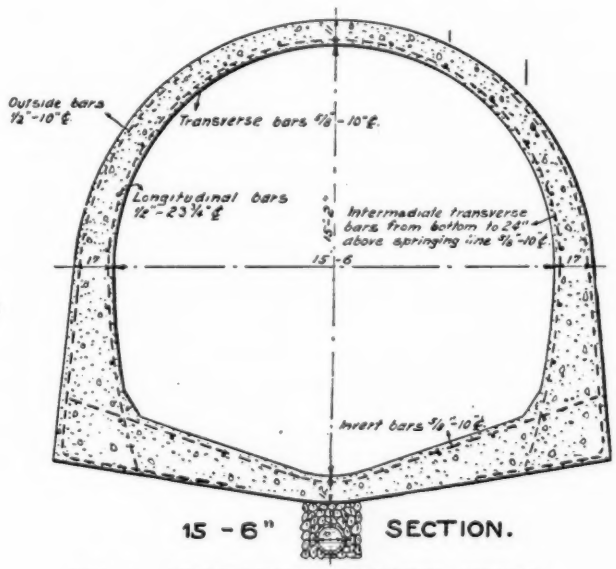


FIG. 8. REINFORCED CONCRETE SEWER, LOUISVILLE, KY.

LABORATORY ON WHEELS.

LABORATORY ON WHEELS.
Side View of "Laboratory on Wheels," showing air intake and rain gage on roof.

Used in atmospheric tests by smoke abatement experts.

By Hugh Pattison,
Electrical Engineer of "Committee on Smoke Abatement and Electrification" of the Chicago Association of Commerce.

NO work of the Chicago Association of Commerce is of greater importance than that in which its committee on smoke abatement and electrification is engaged. This work includes a determination of the present conditions and a study of methods of improving them. The word electrification in the title of the committee shows that the association has in mind the possible electrification of the steam railroads within the city limits. Locomotive smoke is one of the most prolific sources of nuisance and at the same time one which is most difficult to reduce and keep within reasonable limits except by absolute prohibition of smoke-producing motive power.

A Laboratory on Wheels

The committee is conducting its survey of atmospheric conditions in all parts of the city by means of a "laboratory on wheels," which is a novel and efficient application of the automobile to a special service.

William Hoskins, the consulting electrical engineer of the committee on smoke abatement and electrification of railway terminals, has written for us the following description of the traveling laboratory:

"In order to carry on a proper study of this problem, it was found necessary to make numerous chemical analyses of the city atmosphere in various portions of the city, and with the use of sufficient volumes of air to insure average conditions at the point investigated as well as to permit of an accurate determination of those constituents existing in minute quantities. It was impracticable to take samples of sufficient size which might be subsequently analyzed in the laboratory, and it was also impracticable to establish testing stations at sufficiently numerous points to ascertain the facts desired. It therefore was finally decided to design a portable laboratory which could be moved from place to place and which would so far as possible contain all the required apparatus for conducting analyses of the atmosphere at any desired point, and which would enable the employment of large volumes of air and be independent as to the time during which the tests might be carried out.

"A well-known form of automobile delivery wagon was selected with a specially

designed closed body. This car is operated by means of an ordinary two cylinder engine and has a body enclosed 9 feet long, 4 feet 8 inches wide, and 3 feet 3 inches high. The illustrations show the outside appearance very well and the interior arrangement of the apparatus and supplies. In designing the arrangement of the apparatus, reagent bottles, etc., it was necessary to take into account the fact that this apparatus would have to be transported over the rough streets of the city, and the possibility of breakage prevented. It was necessary to devise methods of analyses which were applicable as well as accurate under the conditions of work necessitated by the small available space and because of the exceedingly minute quantities of some of the constituents of the air which it was desired to determine.

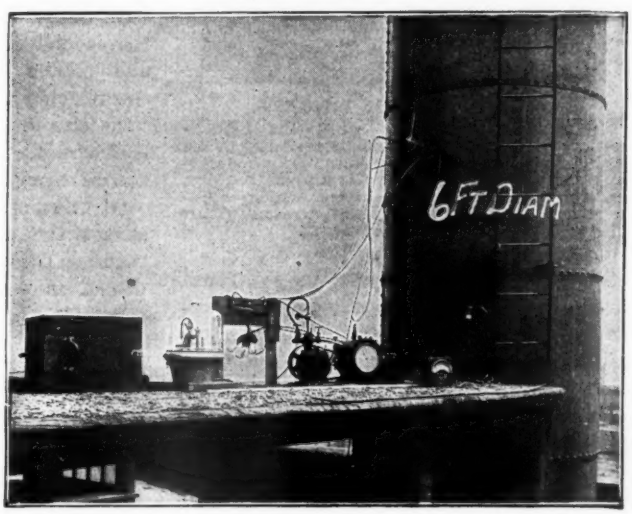
"In carrying out this investigation, the runs cover ordinarily about eight hours, and are made both during the daytime and at night. A storage battery is employed for operating an electric motor which is connected with a pressure pump, for drawing the air thru a specially arranged filter and then thru the various absorbing solutions. A barometer and hygrometer, a wind gage and other apparatus are carried, and frequent determinations of the meteorological conditions of the atmosphere are made and recorded.

Determining Condition of Air

"The amount of carbon dioxide is determined every hour and a half thruout the test, the total quantities of sulphur compounds, nitrites, ammonia and chlorine are also determined. The dust collected in the filter is weighed and then microscopically examined to determine the nature of the material collected and photomocrographs of the contents made.

"Photographs of the filters are also made in order to record their relative color, as the color may or may not have a direct relation to the amount of soot in the air and may or may not have a relation to the total weight of dust, etc., collected. It is believed that this is the first time that an attempt has been made to so completely investigate the composition of the atmosphere of a large city, and certainly it is the first time such large volumes of air have been handled for the purpose. The average volume of air passing thru the apparatus during a single test is about 1,000 cubic feet. This insures an exceedingly accurate determination of those constituents which exist in very minute quantities, and an accurate measure of the amount of solid particles in the air and their nature.

"It is believed that the facts obtained from the very numerous tests contemplated during this investigation will throw much light, not only upon the gen-



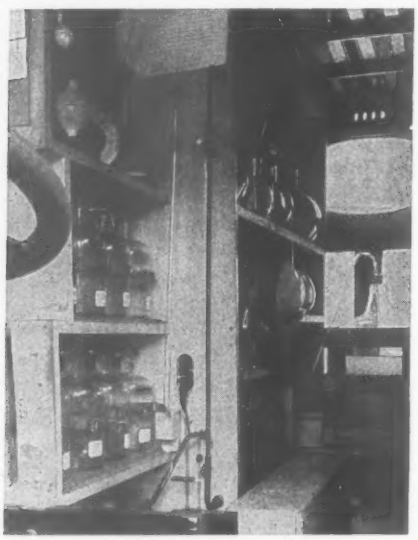
Taking a sample of smoke from a factory chimney.

eral composition of the atmosphere of Chicago under a great variety of conditions, but will also indicate any special or local contamination in any particular district of the city."

One photograph shows the apparatus set up to take samples of the flue gases from a chimney and determine their character, and thus get valuable information as to the results of the method in use of operating the furnace, as a basis for instruction to engineers and firemen as to proper methods of handling and firing furnaces, and the coal in use.

Measuring Smoke from Chimneys

The first step in this process is the recording of the actual conditions as to



LABORATORY ON WHEELS.

Interior of automobile air-testing laboratory. In addition to the necessary flasks and tubes for conducting the various determinations, the car carries a storage battery, an air pump and an air meter, which maintain and measure a constant stream of air through the testing instruments.

emission of smoke by chimneys. There are some 15,000 stationary smokestacks in the city at manufacturing plants, hotels, apartment houses, central heating and lighting plants. These have been classified as to their essential characteristics, such as steam pressure, kind of coal used, uniformity of load on boilers, and the like, and 1,000 typical stacks were selected, with the same proportion in each class as in the total, for careful observation. Fifty of these have been selected for more detailed study with chemical determinations of furnace and flue gases.

The observer is equipped with the Ringelmann chart, which shows, by proportions of black and white area, six grades of color from white to black, with equal steps of darkening of the gray resulting from the increase in area of black in proportion to white in the four intermediate divisions of the chart. He is supplied with a record chart, with six spaces corresponding with the six grades in the scale on the chart. The observer compares the smoke issuing from the chimney with the scale and puts a dot in the space on the record chart for the grade of smoke observed. The record chart is ruled for observations every minute during the day.

This observer then selects a location within view of two smokestacks whose performances the committee desires to survey.

Starting, let us say, at 8 o'clock, he observes the smoke emitted by the first of these stacks, compares it with a Ringlemann chart and marks down the density indicated by putting a dot in one of six spaces on the chart. These places signify, respectively, zero, 20 per cent., 40 per cent., 60 per cent., 80 per cent. and 100 per cent. of smoke density.

At one-half minute past 8 he observes the second chimney in the same manner and makes a similar record upon the second chart.

At one minute past 8 he observes the first chimney again and makes a second record upon his first chart.

At one minute and a half past 8 he observes the second chimney, and so on thruout the day. Thus he keeps a record of smoke units taken at one minute intervals for a period of one day.

Why the Stack Smokes

At the end of the day he visits the engineer of each plant he has observed. He finds out whether any unusual conditions were present during the day; he inquires searchingly as to the methods of stoking and the features of the equipment used.

He inquires what kind of coal is burned, how frequently the furnace is fired—in short, he gathers all the information which to the practical mind conveys a complete understanding of the conditions existing in that plant.

He also counts up the units of smoke observed thruout the day and reduces his grand total to a percentage representing the degree of "badness" of the chimney's performance.

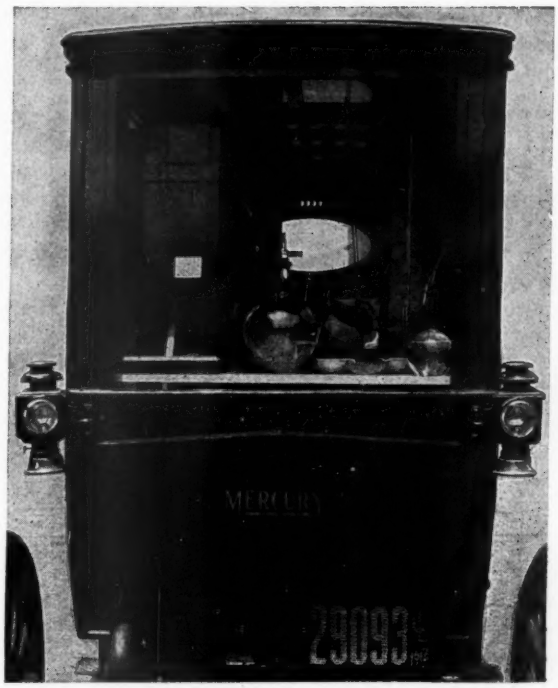
Scale of Good Behavior

A chimney that shows 2 per cent. of smoke is regarded exceptionally good; a chimney showing 24 per cent., 36 per cent. or even more, is considered exceptionally bad.

Locomotive Smoke

This same method of observation is now being applied to the railroads of the city.

Observers are stationed at intervals enabling them to keep a constant watch upon locomotives moving in or out on a given line.



LABORATORY ON WHEELS.
Front view of car, showing operator making a chemical determination.

As an engine starts out it is observed by the first of the committee's corps, who keep one minute interval records as long as it is within his eye-shot. As it passes beyond, it comes within the range of the second observer, and so on until it passes beyond the field of the committee's investigation.

Magnitude of Records

To cite an instance of the thoroness of the committee's methods, it was estimated that to classify the records which the committee obtains of the train and engine movements on every unit of track within the city limits, would keep busily employed a force of fifty men for four years—the records in question referring to the operations of six typical weeks in a year. The number of records covering a single week's train movement is approximately 110,000.

Facts Analyzed by Machine

To deal with such a mass of figures it is necessary to use a "sorting machine," a device successfully employed by the Census Bureau, mechanically and infallibly classifying the records in any manner desired at the rate of 16,000 an hour.

Chicago in the Lead

While several cities in the Central States have made thoro studies of considerable portions of their smoke problems, notably St. Louis, Cleveland, and Pittsburg, no city has devised so comprehensive a plan for the study of the whole problem, and no city has gone into the details in so thoro a manner.

There is no evidence that the committee is wearying of its work or is failing to obtain the considerable sums of money necessary to carry it on at a reasonable rate of progress, so that within a reasonable time we may expect a report which will clear up many doubtful questions for all cities and will offer a feasible solution of Chicago's most vexing problem in the line of improving its conditions, both as to civic beauty and the health of large numbers of its citizens.

WOOD BLOCK PAVING IN MINNEAPOLIS.

BY ELLIS B. DUTTON, ASST. CITY ENGINEER.

THE city of Minneapolis began laying creosoted wood block paving in 1902. Citizens who had seen the creosoted wood blocks laid in Michigan Boulevard in front of the Auditorium in Chicago liked the looks of it so well that they thought it would be a good pavement for Minneapolis. This resulted in the city council awarding a contract for 13,500 square yards of 4-inch yellow pine creosoted blocks treated with 12 pounds of kreodone oil and ordering the pavement on Tenth Street South from First Avenue South to Park Avenue. This street was quite well traveled, and would afford a good test of the value of the creosoted wood block paving. The city engineer was directed to pave this street by day labor, which he did by doing the grading and putting in a 6-inch natural cement concrete foundation, upon which was spread a 1-inch cushion of sand, upon which the blocks were laid. There were no cross expansion joints used, but a 1-inch expansion joint was placed along each side of the street next to the curb. These joints as well as the joints between the blocks were filled with paving pitch, and the whole surface was covered with one-quarter of an inch of sand to absorb the excess of pitch on top of the blocks.

This street has given excellent service and the repairs have been almost nothing —only amounting to about one-tenth of a cent per square yard per year. The surface at the present time, after eleven years of wear, is fine, as may be seen from the accompanying photograph. The wear of the blocks on the street has been about one-eighth of an inch, and there are no signs of decay appearing on the surface, or in any of the blocks which have been taken up from excavations made. Having this street as a sample, there has been laid in the various years to January 1, 1912, about 968,000 square yards of creosoted blocks, as shown in the table below, at a cost of about $2,500,000.

CREOSOTED WOOD BLOCKS ON FOURTH AVENUE, MINNEAPOLIS, MINN.
This view shows the City Hall and County Building on the left; Chicago, Milwaukee & St. Paul Station in the background.

Year.	Square Yards.	Cost.
1902	13,600	$37,700
1903	31,000	78,700
1904	60,000	155,500
1905	45,000	114,200
1906	76,000	199,900
1907	104,000	291,900
1908	167,000	383,200
1909	143,000	396,400
1910	157,000	370,900
1911	163,000	437,500

This was laid on about 93 different streets and the average cost has been $2.52 per square yard for the complete paving, including grading, concrete foundation, blocks, filler, etc. This makes the total length of streets paved with creosoted wood blocks about 61 miles.

During the ten years passed there were laid about 958,000 square yards of all other classes of paving, as follows:

PAVING IN MINNEAPOLIS.
Filling Joints in Finished Pavement.

Kind.	Square Yards.
Brick	220,000
Granite blocks	247,000
Sandstone blocks	286,000
Macadam	206,000

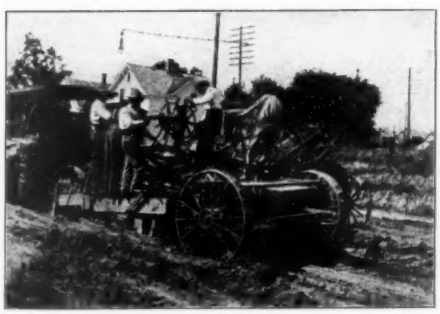
This does not include sheet asphalt, as the area has decreased about 42,000 square yards in this period, having January 1, 1912, 164,000 square yards, the most of which has been resurfaced during this time.

The class of traffic on the creosoted wood block streets varies from light traffic to very heavy traffic for a city of this size, about 180 tons per foot of roadway, and about 4,200 vehicles in 12 hours. The tendency is always to increased traffic on a well-paved street, especially if not all of the parallel streets are paved, and the tendency is also an increase in the use of motor vehicles, especially for the moving of heavy loads. This brings up the thought for the increase of the thickness of the foundation for all kinds

PAVING IN MINNEAPOLIS.
Laying Concrete Foundation.

of pavement. If the use of motor trucks increases, the loads will also increase, and while 4 tons was a big load by teams, 8 tons and more will be carried by trucks. What is this increased loading going to do with a pavement constructed for the team traffic, and what and how shall we build for the increased loading? This is a subject engineers should investigate, both for city streets and also for the good roads in the country.

The maintenance cost on this class of paving is very low, the cost in 1911 being less than one-tenth of a cent per square yard per year, which is a pretty good showing, as same has been in for ten



PAVING IN MINNEAPOLIS.
Traction Grader at Work.

years. Third Avenue South was laid in 1903, and some yellow pine blocks left over from 1902 were put in this street. Blocks were removed in 1911, and showed

a wear of one-eighth of an inch for the yellow pine, and one-quarter of an inch for the Norway pine blocks, under absolutely the same conditions of traffic, being contiguous blocks.

Our specifications for blocks used in 1903 and 1904 were 12 pounds of "kreodone" oil per cubic foot. In 1905 we made a definite specification for the oil, which was for specific gravity of 1.09 at 20 degrees centigrade; water allowed in oil, 2 per cent.; distillation centigrade:

150 degrees.....		0 per cent.
170 degrees.....	0 to	2 per cent.
210 degrees.....	6 to	8 per cent.
235 degrees.....	20 to	30 per cent.
315 degrees.....	40 to	50 per cent.
355 degrees.....	60 to	80 per cent.

Amount of oil per cubic foot, 16 pounds.

In 1907 the specifications were changed, requiring an oil of a higher gravity, as follows: Specific gravity, 1.12 at 20 degrees centigrade; water allowed, 2 per cent.; distillation centigrade:

150 degrees....	0	per cent.
170 degrees....	0 to 0.5	per cent.
210 degrees....	3 to 6	per cent.
235 degrees....	10 to 20	per cent.
315 degrees....	35 to 45	per cent.
355 degrees....	45 to 55	per cent.

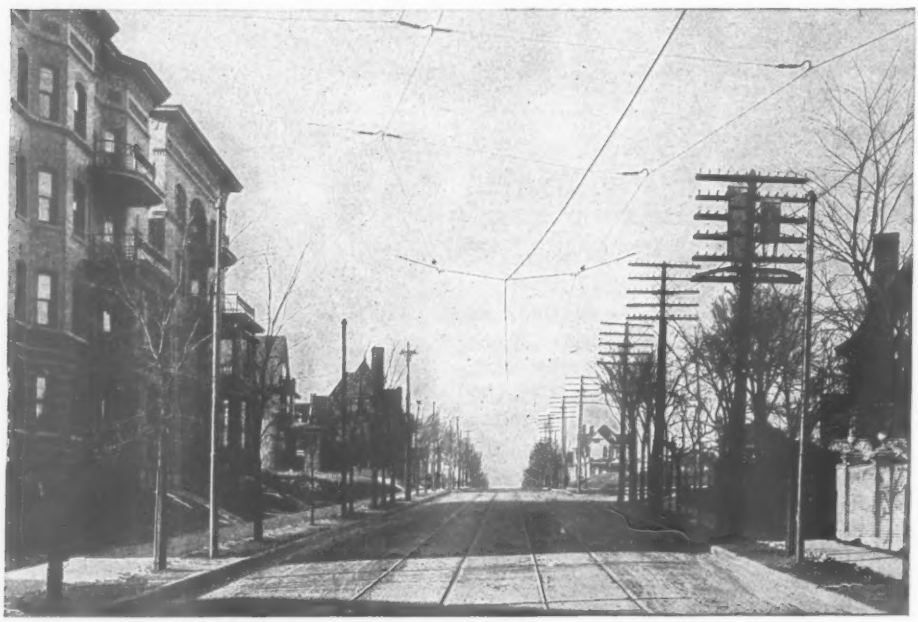
In 1910 the specifications were again changed, as follows: Specific gravity, 1.12 at 20 degrees centigrade; water allowed, 2 per cent.; distillation as follows, centigrade:

150 degrees....	0	per cent.
170 degrees....	0 to 0.5	per cent.
210 degrees....	2 to 4	per cent.
235 degrees....	6 to 16	per cent.
355 degrees....	40 to 55	per cent.

We are using the same specifications for 1912, except the gravity is 1.10 at 38 degrees centigrade, which is the same almost as before. We are still using 16 pounds of oil per cubic foot, and think that it is sufficient, and we have had no trouble from bleeding or buckling.

There is one point in our specifications which is different from most of the specifications at the present time, and this is the retention of the distillates at 210 degrees and 235 degrees, and I think that these are a very essential part of an oil, as it makes an oil which is not altogether a pitch or tar oil.

All of our work is done by day labor, except sheet asphalt paving, which we could not do, as we have no asphalt plant. All materials are purchased on competitive bids under specifications, and con-



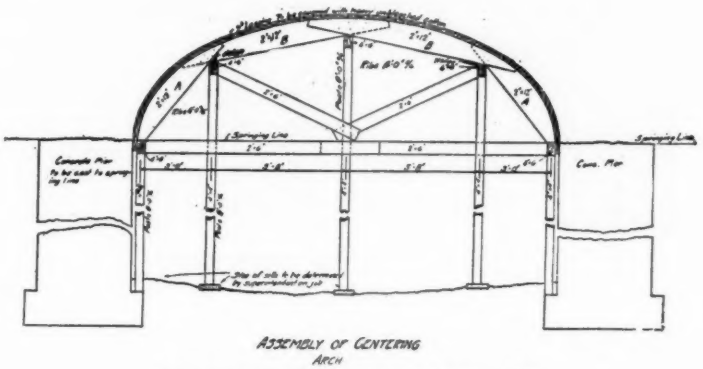
CREOSOTED WOOD BLOCKS ON DOUGLAS AVENUE, MINNEAPOLIS, MINN.
This view shows intersection of Douglas Avenue with Hennepin Avenue, in one of the best residence sections of the city.

tracts are awarded by the city council. All of the labor is hired through the city engineer's office. This method of doing work has been very satisfactory, and I think that we get better work for less money than under the contract system. Take, for instance, the creosoted wood block paving, with an average price of $2.52 per square yard for a 4-inch block complete paving, and I do not know of any other city that gets as much for its money. Under the day labor system we get better work, as there is no reason for slighting the work in any manner. Wages have been increased from $1.75 for ten hours twelve years ago to $2.40 for eight hours at this time. The day labor system is the proper thing, provided you can keep out politics.

We have at the present time about 61 miles of creosoted wood block streets, and there is no better paving laid or can be laid at the present time.

CONCRETE BRIDGE AT METHUEN, MASS.

The recently completed "New Broadway Bridge," which spans the Spicket river on the road between Lawrence and Methuen, Mass., is an interesting example of what may be accomplished in bridge design with concrete when both utility and esthetic appearance are of importance. The bridge is a gift to the town of Methuen from Edward F. Searles, its most prominent citizen.



ASSEMBLY OF CENTERING
ARCH

CONCRETE BRIDGE AT METHUEN,

In designing the bridge the Aberthaw Construction Company of Boston, Mass., who also built it, followed the suggestions of the donor. It was desired to erect a structure that would serve the traffic needs of the town to the best advantage and at the same time add as much as possible to the appearance of that section. Mr. Searles did not desire anything elaborate or ornate, so the bridge was designed with almost severe plainness. It is to its very severity of architectural treatment that much of the attractiveness of the bridge is due.

The bridge is 80 feet long from the end of one abutment to the other, and 74 ft. 2 ins. overall width. It has three arches, each 18 ft. wide, placed on 22-ft. centers. The forms for these arches were detailed at the contractors' office, so that there was no confusion nor delay on the job. The details of these forms are shown in the accompanying cut. The concrete footings are 5 ft. wide and the piers themselves 4 ft. thick. A 1:2:4 mix was used.

Across the central portion of the bridge run the double tracks of the Bay State Street Railway Company. On either side of the car tracks is a roadway, and flanking the roadways are two sidewalks 8 ft.

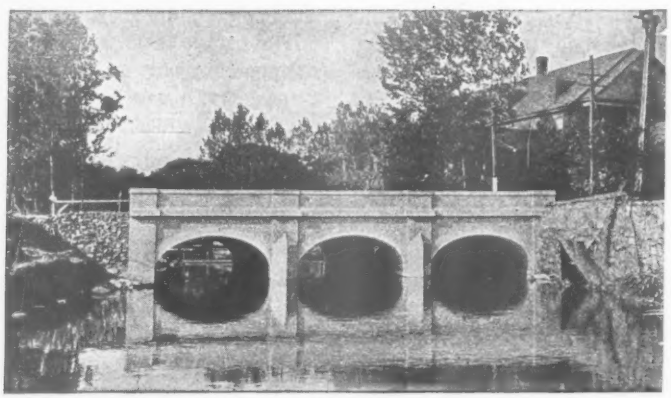
wide. The width of the roadway from one sidewalk curb to the other is just 50 ft. The road is of macadam, and between it and the concrete bridge floor is a 3-ply waterproofing of felt and asphalt.

As will be seen from the photograph, the parapet on either side of the bridge is without ornamentation, being simply a wall with plain capping. The parapet was chosen in preference to an iron railing, as it added enough to the artistic appearance of the bridge to pay for the extra expense. At either end of the piers is a small buttress of uniform cross section which, despite its plainness, adds considerably to the appearance of the bridge. The surfaces of the spandrel and parapet walls are picked, while the edges of the arches, the floor, and the parapet capping were rubbed smooth.

Provision has been made for four electric light posts, one at each buttress. When these are installed they will add to the general attractiveness of the bridge.

In putting in the piers a small coffer dam of 3-in. matched sheeting was sunk into the gravel bed of the river, and the pier centering was hung from the horizontal sheeting braces.

A 16-in. water main that crossed the river at the bridge was provided for in the following manner: The pipe was carried on a 4-in. I-beam which rested on two trench braces at each pier. The braces, placed side by side, were expanded until the pipe was brought to the proper level. Then the concrete was poured around the braces and a permanent support at this level was assured.



CONCRETE BRIDGE AT METHUEN.

THE CHICAGO SUBWAY POLICY.

The committee on downtown streets of the Association of Commerce of Chicago, after a study of traffic conditions and the service of utilities, is unanimously of the opinion that the ultimate goal to be aimed for in the betterment of transportation facilities and the improvement of street conditions in Chicago is the construction of a comprehensive and universal system of subways.

It believes that with moneys now available plans can be devised for beginning the system in the downtown district; such a subway to be eventually extended.

A further belief is stated that any subway system which, in order to alleviate congestion, does not provide for the removal of many of the surface cars and of the elevated loop in the downtown section and which also omits utility galleries, will fail to give an adequate measure of relief.

An immediate revision of car routings in the loop district, and the establishment of ample thru routing of surface and elevated cars is to be given consideration.

December, 1912.

TEMPERATURE STRAINS IN BRICK PAVEMENTS.

By James E. Howard, Engineer-Physicist, U. S. Bureau of Standards, Washington, D. C.

THE United States Bureau of Standards has made an investigation of the strains in brick pavements caused by changes in temperature, which has added considerable to our supply of information as to the reasons for certain defects which appear in brick pavements whose joints have been filled with cement, and so may lead to improved methods of construction. The investigation was made by James E. Howard, an engineer-physicist of the bureau, and in a recent paper he has described the method of making the measurements and has given the course of reasoning depending upon his observations and results.

He defines an ideal street pavement as one which presents a smooth surface of such hardness and rigidity that the tractive effort of moving vehicles is reduced to a minimum; having a surface smooth, without slipperiness; of adequate frictional properties for the safe footing of men and animals and against the skidding of motor-driven vehicles; durable against abrasive wear, and of sufficient compression strength or sustaining power against concentrated wheel and toe calk loads; one in which the physical properties are not materially modified by the usual range of atmospheric temperatures and which is practically non-absorbent and impervious to moisture. These conditions are generally met in a pavement of vitrified brick of monolithic construction, the continuity of which is attained by means of cement-filled joints.

If not confronted with destructive tendencies incident to changes in dimensions caused by changes in temperature, there is apparently no reason why a well-constructed brick pavement should not maintain a state of integrity and successfully endure traffic conditions for many decades of years.

Referring to the physical properties of vitrified paving brick, the crushing strength commonly ranges from 10,000 to 15,000 lbs. per sq. inch, and not infrequently reaching and exceeding 20,000 lbs. per sq. inch. The compressive modulus of elasticity is found to range ordinarily from 2,500,000 to 8,000,000 lbs. per sq. inch, with a value as high as 10,000,000 lbs. per sq. inch occasionally observed. The compressive strength and modulus of elasticity increase as the weight per cubic foot of the bricks increases, while the porosity or rate of absorption of moisture decreases. That is, the more material there is in a given space the stronger and more rigid it is and necessarily less porous. These are features which should be considered in a paving brick, and they are features which are controllable in the process of manufacture, at least the apparent modulus of elasticity is modified by the conditions of burning the brick, while the crushing strength and density certainly can be controlled within limits.

1. STRAIN GAGE USED IN MEASURING THERMAL EFFECTS ON STREET PAVEMENTS.

Expansion of Brick Pavement

As regards the value of the coefficient of expansion of brick, data are not as complete as desired. The values frequently seem to be in the vicinity of .0000040 per degree F., with some examples, however, approaching the values for steels, or above .0000060.

A value of .0000040 has been accepted for the time being in considering some of the phenomena attached to the expansion of pavements, since this corresponds well with the observations which have been made on the behavior of the pavements.

In regard to the significance of the relation between the modulus of elasticity and the coefficient of expansion in respect to the force which the confined material would develop when raised through a

range of temperature of 100 degrees F., taking for example four mud bricks selected from different parts of a downdraft kiln, the following table is presented:

Location in kiln.	Lbs. per sq. in. Modulus of elasticity.	Crushing strength.	Weight per Lbs. cu. ft.	Lbs. per sq. in. Confined Stress!
Top	10,000,000	19,170	144.3	4,000
¼ down.	7,692,000	15,670	136.4	3,076
2/3 "	5,263,000	10,420	130.6	2,105
Bottom..	4,545,000	10,870	125.4	1,818

That is, bricks of these moduli of elasticity would be expected to develop, when confined and strictly prevented from expanding, compressive stresses ranging from 1,818 to 4,000 lbs. per sq. in.

Behavior of Pavement Under Heat

The bearing which these figures have upon the behavior of cement-filled brick pavements is this: the pavements will develop certain compression stresses when the temperature is raised, which stresses will be greater with brick of high crushing strength with high modulus of elasticity in comparison with those of a lower modulus of elasticity. Only a portion of the possible maximum confined stress will, however, be realized, but the relative expansive force exerted should be proportional to the moduli of elasticity, and since the highest values pertain to the strongest brick, those pavements constructed of the strongest material will be capable of exerting the highest stresses which are incident to rise of temperature.

It would in some cases relieve the magnitude and severity of thermal effects to restrict the brick to a grade sufficient to provide adequate abrasive resistance for traffic conditions of a particular street. The endurance of brick pavements against abrasive wear has been found from experience to be so great that no trouble is ordinarily apprehended in that direction. It is believed, therefore, that the selection of the bricks and modifications in the manner of laying the pavement, tending to ameliorate thermal effects, are matters deserving consideration.

The observed expansion of cement-filled pavements, in a direction crosswise the roadway, has corresponded closely to a coefficient of expansion of .0000040 per degree F. In the following table, however, the computed expansion of roadways of different widths is given for a range of temperature of 100 degrees F. for assumed coefficients both of .0000040 and .0000060.

COMPUTED EXPANSION OF CEMENT-FILLED BRICK PAVEMENTS FOR A RANGE OF TEMPERATURES OF 100 DEGREES F.

Width of Roadway.	Assumed Coefficient of Expansion. .0000040	.0000060
4 feet 8 in.....	".0224	".0336
14 feet	.0672	.1008
25 feet	.1200	.1800
30 feet	.1440	.2160
40 feet	.1920	.2880
50 feet	.2400	.3600

The table gives the total computed expansion, one-half of which might be taken as occurring at each side of the street.

Enormous Stress in Brick

Although the maximum stresses which the confined material could display would range in round numbers from 25,000 to 50,000 pounds per individual brick, yet the street curbing could not ordinarily afford any such reaction. Curbing which is backed up by earth filling yields to moderate pressures when they are long sustained, and in a crosswise direction pavements would not be expected to develop forces of very great magnitude in the absence of substantial buttresses. The fact that the middles of roadways rise during the period when the bricks reach a high summer temperature is occasioned and facilitated by the crowning of the roadway. The usual pavement is, in transverse section, a bent column, of very slender proportions, which easily rises, increasing the crowning of the arch, and may result in the formation of longitudinal cracks.

Observations on Pavements

Referring to observations which have been made on pavements in Cleveland, Ohio, and vicinity, covering a period of a few months over a year, they have embraced measurements on thermal effects, in which attention has been directed to changes in lengths taken both lengthwise

and crosswise the roadways. Reference lengths of 20 inches each were established and defined by means of small bronze plugs inserted in the pavement. The tops of the plugs were about 3/8 inch below the surface of the pavement and protected against traffic by paper washers and putty. These plugs had in their upper ends small drilled and conically reamed holes, from center to center of which measurements were made.

Strain Gage

A strain gage of the style shown by figure No. 1 was used for measuring purposes. Generally the readings of the gages checked to a ten-thousandth of an inch, altho that degree of accuracy will not be claimed for the work. It is believed, however, that changes in the reference lengths were measured reliably within two ten-thousandths of an inch. A steel reference bar is used in connection with the strain gage. The comparatively short gaged lengths of 20 inches each are preferred instead of longer ones for inquiries of this kind, where specific and detailed information is sought on the behavior of the pavements.

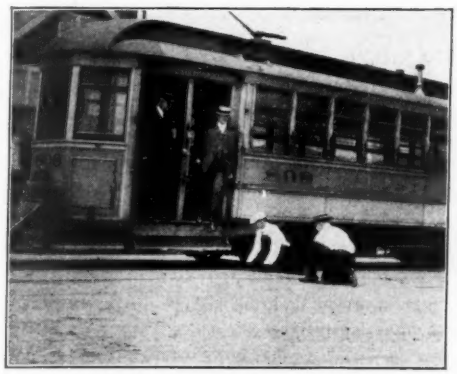
Depression of Tracks by Cars

In addition to the measurements with the strain gage on changes in dimensions due to changes in temperatures, the work at Cleveland included a number of observations on the elastic depression of loaded pavements and the depression of trolley tracks under the weights of cars. Figure No. 2 illustrates the method of measuring the depression of trolley tracks by means of a levelling beam. One end of the beam rested upon the track, the other end, 4 or 7 feet away, upon the pavement. The beam is provided with a sensitive level and micrometer elevating screw. There is a general depression of the pavement and roadbed in the vicinity of a car, but slight in amount when compared with the depression of ordinary trolley track. The depression of trolley track usually takes place to such an extent as to make it undesirable to bond the pavement to it. When a very sensitive level bubble was used the depression of the pavement could be detected some ten feet from a trolley car in the direction of the curbstone. This was found on a tar-filled pavement.

At an intersection the approach of a man when 12 feet distant was indicated by this sensitive level. Monolithic brick pavements are very elastic. They depress locally under loads and spring back when released.

Formation of Cracks

In conjunction with the measurements of changes in the 20-inch reference lengths there were observations on the incipient formation of transverse cracks in freshly grouted pavements. Dark lines developed in a freshly grouted pavement before the street was opened to traffic. These dark, hair lines are taken to represent cracks in an early stage of development. The



2. MEASURING DEPRESSION OF TROLLEY TRACKS BY MEANS OF LEVELING BEAM.

first 24 to 48 hours after grouting is a critical period in the laying of a cement-filled pavement. The grout during the first few hours after applying has very little strength, and, like cement structures in general, it cannot safely be disturbed during the period of setting.

A drop in temperature of the brick work of 30 degrees from day to night is not uncommon. An uncovered pavement can hardly endure this drop in temperature without starting incipient cracks. A thin layer of sand on the pavement aids somewhat against the joints being put into a state of tension by the lower temperature of the night. It is probably quite impracticable to use a sufficiently deep layer of sand entirely to protect the pavement

against this drop in temperature, while the grout is acquiring strength. Incipient cracks appear at first as fine dark lines, darkened apparently by the presence of moisture. Later the lines are white, caused probably by the lime in the cement of the grout going into solution and then being converted into the carbonate. These phases have been observed, altho they may not be conspicuous in all cases.

It would seem that a period of favorable weather conditions would be met, for monolithic pavement construction, when minimum diurnal changes in temperature prevail, immediately following the time of grouting. Cement users are all aware of the necessity of keeping the cement quiescent during the period of setting, and the same necessity exists in the case of grouted pavements as in other kinds of cement work. The extent of the surface exposed in a pavement precludes the adoption of means which would be practicable and adequate to avoid excessive thermal strains in certain other engineering examples. It is safe to say that thermal cracks must be recognized as a probability and their presence expected, and that they may have their origin in point of time prior to the opening of the street to traffic.

POWER FROM SANITARY DISTRICT.

THE board of trustees of the Sanitary District of Chicago, at its recent meeting, approved of the proposal of the Dearborn Street Improvement Association to have the district install, at its expense, one hundred and seven trolley poles on Dearborn street, from Lake to Polk streets.

With the final approval of the sanitary district ends a long battle waged jointly by the committee on downtown streets of the Chicago Association of Commerce and the Dearborn Street Improvement Association to secure an adequate lighting system upon one of the most important streets in the downtown district of Chicago.

For several years the Dearborn Street Improvement Association has attempted to arouse the property owners on the street to the necessity of good street lighting. The city has been unable financially to give more lights to Dearborn street than at present installed without discriminating against other districts where more lights are constantly being demanded. It remained for the committee on downtown streets of the Chicago Association of Commerce by an aggressive campaign of education to demonstrate to the property owners on the street that, aside from other considerations, an adequate street lighting system was a good investment.

The engineer of the committee, L. A. Dumond, personally called upon each property owner and secured his signature to an agreement providing that the cost of installation and maintenance of the proposed lighting system was to be paid for on a front-foot basis.

The lighting system to be installed contemplates the mounting of one Lynn flaming arc lamp of 1,100 candle power upon each trolley pole on the street. The lamps will be suspended from a bracket adopted by the city, and which will fit by means of a collar to the top of the trolley pole. An idea of the wonderful lighting effect of the proposed system may be obtained when it is considered that the present twenty-three lamps upon the street give less than 11,000 total candle power, while the new system will give a total of 117,700 candle power.

The cost of installation of $.50 per front foot was assessed upon each property owner. It is expected, however, that the actual cost of installation will permit the refunding of part of this amount. The Sanitary District of Chicago will do the construction work as a part of the existing contract between the city and the sanitary district for the mounting of 10,000 arc lamps in Chicago. The city of Chicago will operate a new system, using power from the sanitary district, and bill the Dearborn Street Improvement Association for the actual cost of operation.

December, 1912.

EDITORIAL COMMENT

GOOD ROADS PROPAGANDA.

This is the season of good roads conventions, and, fortunately, most of the organizations which existed solely for the benefit of individuals or special interests have been exposed and have gone out of business.

The American Highway Association held a very successful convention at Atlantic City in October, at which many valuable papers were presented and a large and instructive exhibit of road materials, machinery and methods was made. National aid in road building was a very prominent subject of consideration, and the campaign to induce Congress to grant such aid may be said to be launched. MUNICIPAL ENGINEERING has never advocated the general engagement of the national government in road construction, still less the distribution of sums of money among the states for their expenditure upon their own road building, but is heartily in favor of liberal appropriations in support of educational work, by means of which local authorities and their constituents can be shown the advantages of good construction and the economy of the same can be demonstrated. This will require some expenditure on road construction, either independently or in conjunction with the local authorities, but if this expands into general road construction by the national government a monumental error will have been committed. Likewise, it may be proper to construct occasional roads, which might be termed National Highways, but they can be promoted locally and constructed locally, as is now being demonstrated, and should not be aided directly by the national government. If the nation desires to build a highway for any particular purpose, it should be done independently, but, again, if this is but the entering wedge to start a stream of appropriations for general road construction with national funds, the driving of this wedge should be prevented.

The American Road Builders' Association meets in Cincinnati the first week in December to discuss problems of road construction and maintenance. It is unfortunate that this association did not join forces with the American Highway Association, and the general tendency toward conservation of time and effort will doubtless bring about the consolidation hereafter. Meanwhile the latter association will do well to confine itself strictly to administrative and constructive features, including especially the subjects of maintenance and operation.

Indiana is the first state met on the way west from the Atlantic which does not have a state highway commission, and its eastern boundary is on the line which separates the states which make appropriations in aid of road building from those which do not. It bids fair to be surrounded by the states making appropriations for building roads, for states as far west as California have joined the progressive band and the fashion is extending eastward. The Indiana Good Roads Association will hold a convention following that in Cincinnati, to inaugurate a campaign in the new legislature for legislation to improve the roads of the state. The principal subjects for discussion will be national aid and the proposed Indiana state road laws, including one providing for a highway commission. At least one session will be devoted to problems of construction, maintenance and repair. This is a local convention to disseminate information and arouse enthusiasm over the right treatment of local problems, but national aid system seems to be in favor with the officers of the association and to demand a hearing. Indiana has more miles of road which have been improved for local purposes than any other state, but it has no roads suitable for through traffic and none which are adequate for use as main roads to the markets in the various counties. It has attained its present position in the good roads column by means of the district system, county and township, with little co-operation between the two classes of corporations, but it seems to be impossible to meet the modern situation by the same agencies. Hence the agitation for a state organization which can unify the work upon these main roads, at least, to which is added the very appropriate proposition that the state shall pay a part of the cost of the main roads. Material advancement in road legislation is expected of the legislature which meets in January.

MUNICIPAL SANITATION.

The field of municipal sanitation is now so large that the progress in it cannot be covered in an occasional number of a magazine, even if it were devoted entirely to that subject. This number of MUNICIPAL ENGINEERING gives some statement of the present state in a few lines in which advancement has been most rapid or in which it is most needed.

Fifteen years ago it was hard to find a city which would confess that it had concrete sewers in use, altho a few cities had such sewers which had been in use more than thirty years. When Portland cement became plentiful and reasonable in price its use was gradually extended into the field of sewer construction, until now it is in such common use that cities boast of the amount of such construction installed, and those which built the early pipe sewers point to them with more or less pride, unless they were made with natural cement, in which case they may have failed and been replaced with better materials.

The adaptation of cement to sewer construction has been at the expense of some failures because the proper use of the new material was not understood, but in the main it has been successful in the larger sizes. Concrete is usually able to compete with brick in cost, and is more adaptable to special designs and peculiar forms of intersections and other special structures, and so its use will doubtless extend still further. For the smaller sizes the old stand-by, vitrified clay pipe, still holds its own in both service and cost, and concrete has a more serious competition.

The article on "Concrete in Sewer Construction," elsewhere in this number, notes a few cases in which alkali, acids and sewage have caused concrete to disintegrate, and some abrasions from rapid passage of rough materials along the bottom are noted, but these seem to be of no more frequent occurrence than in ordinary brick sewers, and the custom of lining the inverts of brick sewers with vitrified brick, which has developed of late years, has been extended to concrete sewers.

The data given in the article referred to, and in others, are only samples of what are available, but are sufficient to give a good idea of what is being done in the development of concrete sewer construction.

STANDARD SPECIFICATIONS.

The American Society of Municipal Improvements has brought its sets of standard specifications for street pavements and sewers almost to their ultimate form during the past year. This organization and the Society for Standardizing Paving Specifications have been working on parallel lines, with many men as members of the corresponding sub-committees of the two societies. As a consequence, very close agreement of the two sets of specifications has been reached.

The A. S. M. I. has a somewhat broader field because its general committee on standard specifications is prepared, through its sub-committees, to consider and prepare specifications for any construction in which municipalities may engage. This year it has adopted a very full and complete set of sewer specifications prepared by a committee composed of sewer experts of the highest reputation, and thus one of the few gaps in the list of standard specifications has been filled adequately.

There is good prospect of the two societies mentioned joining forces during the following year, thus saving the duplication of the past three years and removing the possibility of conflict which might arise if the two organizations were not so harmonious in their feeling toward each other.

THE QUESTION DEPARTMENT

Automobile Ordinances

I will thank you to give some ordinances relative to automobile regulation for a city of 30,000 population, as I want to go into the matter fully and get up an ordinance covering all features of the auto traffic.

R., City Attorney, Idaho.

The city of Cincinnati has produced what is probably the most complete set of vehicle ordinances, including automobiles.

The following are simpler and seem to cover nearly if not quite all the ground. The ordinances are given below continuously, and the divisions between them can be distinguished readily. Having been passed at different times, there is some duplication and there are some slight conflicts. The provision requiring owner to carry his initials has been abrogated by a State law requiring all motor vehicles to carry State numbers and prohibiting cities from requiring additional distinguishing numbers or letters:

It shall be unlawful for any person to drive or operate upon or along any street, alley or public place in the city of ——— any automobile, motorcycle or similar vehicle, unless the person in charge or control thereof shall have first procured a license so to do from the city controller of said city, for which the sum of $—— shall be paid. The city controller is hereby authorized to issue such license only upon the presentation of a permit properly signed by the board of public safety.

For the purpose of this ordinance the terms or names "automobiles," "motorcycles" and "other similar vehicles" wherever and whenever used in this ordinance shall be held to embrace and mean, and are hereby defined to mean, any vehicle driven or propelled upon or along the streets, alleys or other public ways of the city of ———, the motive power of which is electricity, compressed air, naphtha, gasoline, kerosene or steam. Provided, however, that nothing herein shall apply to the operation of any locomotive, trolley car or other vehicle used by any steam or street railway upon or along any track or tracks owned or lawfully used by any steam or street railway company.

Any person desiring a license as an operator of such vehicle shall file a written application therefor with the board of public safety, stating his name and address, and shall present satisfactory evidence of his ability and capacity as such operator. If the board be satisfied that he is a proper and safe person to act as such operator, a permit for such a license shall be issued: Provided, that no such permit shall be issued to any person under the age of 17 years. Any such operator shall, within 5 days, notify the board of public safety of any change of address, and such operator shall, whenever requested by the police authorities, disclose and furnish his name and address and the number of his license.

Any person violating any of the provisions of this ordinance shall, upon conviction thereof, be fined not less than $1 nor more than $100, to which may be added imprisonment not to exceed 6 months in the county jail or workhouse; and the court finding any person guilty of violating any statute of the State or ordinance of this city relating to automobiles or motor vehicles, as herein defined, may revoke said person's license: Provided, that when any person shall be found guilty for a third time of violating any statute of this State or ordinance of this city relating to automobiles or motor vehicles, as herein described, said third conviction shall operate to revoke the license taken out by such person under the provisions hereof, and if such person shall thereafter be found guilty of violating any of the provisions of this ordinance, he shall be fined not less than $25 nor more than $200, and shall also be imprisoned in the county jail or workhouse not less than 15 days nor more than 6 months.

It shall be unlawful for any person, firm or corporation to leave standing in a public street, alley or highway within the limits of the city from one-half hour after sunset to one-half hour before sunrise, any automobile, motor vehicle or other conveyance, carriage, wagon, engine or machine, the motor power of which shall be electricity, steam, gasoline, or any source of energy other than human or animal power, unless there shall be kept burning on the front of said vehicle at least one white light visible for a distance of not less

than 200 feet, and on the rear of said vehicle at least one red light visible for a distance of not less than 200 feet.

No person, driver or operator in charge of any automobile or motor vehicle or carriage described in the preceding section shall permit the machinery of said vehicle to run while such vehicle is standing in any street, alley or public highway within said city without an attendant for a longer period of time than 5 minutes at any one time.

No person, firm or corporation shall use upon the streets, alleys or public highways of the city any automobile, motor vehicle, or other conveyance, carriage, wagon, engine, or machine, the motor power of which shall be steam, gas or gasoline, or any like source of energy, unless such vehicle shall be equipped with a sufficient modern and improved muffler to prevent noise from the exhaust of the engine or engines of such vehicle, and said muffler shall be kept and remain closed by the person operating or in charge of such vehicle at all times when such vehicle is in motion.

No person under 17 years of age shall operate upon the streets or public highways of the city any automobile, motor vehicle or other conveyance, carriage, wagon, engine or machine, the motor power of which shall be electrity, steam, gasoline or any source of energy other than human or animal power.

Any person, firm or corporation violating any of the provisions of this ordinance shall, upon conviction, be fined not less than $1 nor more than $100, to which may be added imprisonment not to exceed 6 months in the county jail or workhouse, and upon a second conviction for such offense said person, firm or corporation shall be fined not less than $25, to which may be added imprisonment not to exceed 6 months in the county jail or workhouse, and upon a third conviction for such offense said person, firm or corporation shall be fined not less than $50, to which shall be added imprisonment for a period of not less than 30 days in the county jail or workhouse.

It shall be unlawful for any owner or operator of any automobile or other motor vehicle to maintain or use any searchlight or blinding light on said automobile or other motor vehicle using any of the streets, avenues, alleys or public places within the corporate limits of the city: Provided, that nothing herein contained shall apply to any automobile used by the police for the city when in the performance of their duties.

Any person or persons violting any of the provisions of this ordinance shall, upon conviction thereof, be fined in any sum not exceeding $20.

It shall be unlawful for any person or persons to drive or cause to be driven any automobile through the streets, alleys or public driveways of the city faster than 8 miles per hour inside of the territory bounded by ———, or faster than 12 miles per hour in any portion of said city outside of the above described territory.

All automobile drivers or owners shall register with the city controller their full names and residences, together with a brief description of their automobile or automobiles, and said automobile or automobiles shall be provided by the owner thereof with his or her full initials in white or aluminum Roman letters not less than 3 inches high arranged in a horizontal line with a space not less than ¾ inch nor more than 2 inches between the nearest adjacent points of the several letters, and placed upon the rear of such vehicle or vehicles: Provided, however, that this section shall not apply to nonresidents of the city not remaining in the city a longer period than 5 days.

All automobiles shall be provided with an alarm bell or horn, and shall carry a lighted lamp from half an hour after sunset until half an hour before sunrise.

All operators of automobiles must slow up in turning corners of streets. (The Cincinnati ordinance requires slowing to half the legal speed.)

Any person or persons violating any of the provisions of this ordinance shall, upon conviction thereof, be fined in any sum not less than $5 nor more than $50.

Ordinances Fixing Rates for Electric Current

Will you kindly send me copies of electric current rate ordinances of other cities?

F., City Attorney, ———, Neb.

The ordinance for Taylorville, Ill., will be found in MUNICIPAL ENGINEERING for November, vol. xliii, p. 322. Lighting rates for Johnstown and Gloversville, N. Y., are given in vol. xli, p. 305. An article on "Specifications for Electric Lighting Contract," vol. xl, p. 37, gives references to a number of articles having considerable information about electric current rates and contracts, franchises and ordinances governing them. One of these, in vol. xxxix, p. 50, gives the form of contract with the consumers for operating ornamental street lamps in Indianapolis, Ind.

Rate for Water in Small Municipal Plant

We are about to complete a water works plant in our village of about 1,000 people. We expect to pump with water power, with a

90-h.p. gasoline engine for emergency in case of low water. We have two good 8-inch wells and pump into a 200,000-gallon tank that is 50 feet higher than any building in the village. The mains are 8-inch, and we have about 4½ miles of pipe. Our pumps and engine are installed in the same building with our light station, operated with the same labor. Now, I would like to ask if you would give us a rate with or without meter. We expect to install meters, but would like a flat rate. L., Mayor, ———, Mich.

Theoretically, the rates for water ought to be determined with reference to the cost of furnishing it. It will be the merest guesswork if a rate is adopted without some careful study of the expense of maintaining and operating the plant and paying capital charges and the probable income, and even then the probable growth of the use of water must be estimated. The range of rates charged by small plants in Pennsylvania is given in an article in MUNICIPAL ENGINEERING, vol. xlii, p. 190, on "Rates for Water." An article in vol. xli, p. 131, on "Water Rates in Small Cities," gives both flat and meter rates in both municipal and private plants in cities and villages of 3,000 to 10,000 population in Indiana, Kentucky and Ohio. Information about rates in all parts of the country can be obtained from the "Manual of American Water Works" ($1.50).

Book Giving Statistics of Water Supplies

I am wanting a book or pamphlet which gives the statistics of water supply in the cities of the United States, or as many of them as are obtainable.

I would like the cost of the plant, distance of the supply from the city, miles of mains in the city, amount of consumption per capita, and population of city at the time the report was made, and the cost per 100 gallons to the consumer. Also, whether or not the city owns plant or a private corporation. Further, if possible, the cost per 100 gallons of pumping the water.

I want to get at what would be a fair price for delivering water by a private corporation in mains a distance of 15 to 20 miles, to a standpipe, from which the city will distribute to the consumer.

I am one who believes a city should own its water supply, if possible.

I suppose, if the statistics I want are published, they will show how much of the water shed is owned by the city, to prevent the supply being contaminated, and the cost of acquiring this land, which I know in some cities has been very large. I take it for granted that where the city owns a settling basin and purification plant the cost of this will be given. F., ———, Tex.

Is there any place, to your knowledge, where the water pressure in the different cities in this country can be obtained, and also what is the probable cost of same? I would appreciate any information you can give me on this subject.

Z., Chicago, Ill.

The book giving the largest part of the information desired is the "Manual of American Water Works" ($1.50). As the last edition of the book was published in 1897, it is far from being up to date, but it gives many of the items desired as they existed at that time.

The volumes of "Statistics of Cities" issued by the U. S. Census Bureau give some of the items. Thus, that for 1907, giving statistics for cities of over 30,000 inhabitants owning their own water works, gives mileage of mains, millions of gallons supplied, population, earnings, and cost of service in total, per capita and per million gallons.

Some articles in MUNICIPAL ENGINEERING will be of value, such as the articles on water rates in vol. xli, pp. 131 and 291, vol. xl, pp. 103 and 344. Some data for small cities are given in vol. xlii, pp. 118 and 190. Much of the information asked for is given regarding a number of cities between 25,000 and 50,000 population in vol. xxxvii, pp. 258, 330 and 400.

These, and such other data as may be obtained, give only the results in the cities for which they are given, and are of no special advantage in a particular case. It would seem that the proper mode of procedure would be to make a preliminary rough estimate of the cost of the project as a basis for a decision as to whether the city and the citizens could afford to pay for the service rendered. Then, if it is decided that the project is feasible, a careful estimate based on completed surveys and plans should be made and the price for the water fixed so as to meet all expenses, interest and depreciation or sinking fund charges on all the actual cash capital required, whether represented by bonds or stock. Or an agreement can be made by which the city will have the opportunity to keep account of proper cost of construction, and the price to be fixed after the cost is ascertained upon an agreed basis of capital charges and profit on cost of maintenance and operation. The latter is the most equitable method, and when the city purchases the water outright and makes the distribution of the water to consumers in its own system of pipes, is very easy to keep in satisfactory condition. Contracts for water can be made between the city and the company each year, or can be made for definite terms of years, and by having the books open to both the parties to the contract the price of the water can be fixed for each new contract so that the water company will get full return for its investments and services and the city will know that it is not paying inordinate profits upon the cash capital actually involved.

Effect of Hypochlorite on Health of Water Consumers

Will you kindly inform me, through your question department, whether there is any evidence or reason to believe that the continued use of hypochlorite of lime for water purification is or may be injurious to health?

E. R. W., ———, Mich.

There has been some question raised as to the possible effect of hypochlorite of lime upon the consumers of water treated with it. Doubtless it would have an injurious effect if it were in sufficient quantity, but, like alum in the coagulation method of treating water, the supposition is that the amount added to the water is only sufficient to perform the required duty, and that it all disappears before it reaches the consumers, therefore there is nothing left to affect their health. What have our readers to say?

Methods of Garbage Collection

I am in search of information relative to systems of garbage collection in cities of about 7,000 population.

I would like to get copies of ordinances and any further data that would assist in installing a good system in this city.

M. M., ———, Wis.

In vol. xlii, p. 252, will be found a full list of articles which have appeared in MUNICIPAL ENGINEERING upon the subjects of garbage and refuse collection and disposal, in which can be found all the information desired. Articles which have appeared since the date of the above list are "Private Collection and Disposal of Waste," vol. xlii, p. 468; brief reports of methods in use in a number of cities in vol. xlii, p. 320; "Collection and Disposal of City Wastes," vol. xlii, p. 385, giving an abstract of a report on the subject by the Ohio State Board of Health; "An Individual Garbage Destructor," vol. xliii, p. 257.

Some data on the subject will be found in this number, and still more information is in preparation for early publication.

Assessment of Part of Bridge Cost on Street Railway Company

We are confronted with the necessity of building a new bridge across a river on our principal business street. The old bridge carries a double-track street car line, which occupies practically all of the roadway, which is 18 feet wide. The bridge was originally designed for highway traffic only, and the floor system was later strengthened to carry street cars. Heavy interurban cars are now being run over the line, and the bridge has deteriorated considerably from rust, and is no longer considered safe. Moreover, the city has more than doubled in population since the bridge was built, and has outgrown the old bridge, and desires to construct a modern bridge of suitable width and design at an estimated cost of about $70,000.

Now, it is necessary to build this bridge much stronger and heavier than would be required without the street car line, and we think the street railway company should be willing to bear a proportionate share of the cost of the bridge. This they refuse to do, however, holding that the city, in giving them permission to cross the old bridge, undertook the obligation of maintaining a crossing for them.

It seems to me that this same question must come up in many other cities, and that there must be some better way than a fist fight to make the railway company stand its portion of the cost. I presume we might shut them off the bridge, but this would immediately deprive half the city of street car service, and would amount to a "fist fight."

CITY ENGINEER, ———, Mich.

The solution of this problem depends so much upon the terms of the franchise of the street railway company that no definite opinion can be expressed. Equity would demand that the street railway company pay part of the cost of the bridge, and unless the franchise definitely prevents this there would be a good chance of getting a court decision to this effect. Modern franchises and recent legislation take care of the question, and court decisions on such matters almost always follow the equities of the cases, if not absolutely prohibited by the letter of the contracts or franchises.

Ordinance Regulating Dance Halls

I would like to get copies of one or more ordinances prohibiting and punishing indecent forms of dancing in the common dance halls of a city.

M., City Attorney, ———, Mont.

Will any of our readers supply what our correspondent needs? The following ordinance leaves the matter in the hands of the police for regulation, aside from the prohibition of public dances, and is the usual method of handling the matter, this being somewhat more strict than most of the ordinances:

No person, firm, corporation or association shall keep a public dance hall within the city of ————, which shall be open promiscuously to the public, either upon the payment of an admission fee or otherwise; nor shall any person visit or attend any such public dance house or public dance held therein.

No person, firm, corporation or association shall knowingly let or lease to another any room, house or building for the purpose of having carried on or maintaining therein any public dance house, to which the public are invited promiscuously to visit or attend, either upon the payment of an admission fee or otherwise.

It shall be unlawful for any person, firm, corporation, club, society or association to give or hold any dance in any room, hall or building, other than a pri-

vate residence, without a permit or license first obtained from the city controller, for which the sum of $1 shall be paid. The city controller is hereby authorized to issue permits or licenses for dances only upon the presentation of applications properly signed and approved by the chief of police.

Any person violating any of the provisions of this ordinance shall be fined in any sum not less than $10 nor more than $500.

Specifications for Bituminous Macadam Roads of Low Cost

I should esteem it a favor if you would oblige me with a specification for tar macadam road. The authorities of the country municipality in which I live contemplate resurfacing the existing o rdinary macadam road with tar macadam. This will probably entail laying from three to four inches on top of the present roadbed. The proposals submitted by the bitulithic company and the tarvia people are too expensive to be entertained. If I succeed in obtaining a reasonable specification through your kindness, I propose, as mayor of the municipality, to call for tenders through the press for the work required.

P. R. W., Mayor, ———, Can.

Possibly the need will be filled by the specification for tar macadam in the last volume of proceedings of the Society for Standardizing Paving Specifications ($5), of which J. B. Hittell, City Hall, Chicago, Ill., is the secretary. These specifications will make a good pavement. If this is still too expensive, the specifications for making tar roads by the penetration method or for oiling roads may be used. These are cheaper than the constructions named, but their quality and durability are reduced in like proportion, or even more than the reduction in cost.

The following articles in recent numbers give descriptions of methods, figures of cost or specifications, and may supply all the data desired:

In vol. xlii: "The Park Heights Experimental Road, Baltimore," p. 83, giving brief statements of materials and methods used and results; "Bituminous Macadam Construction," p. 92, giving descriptions of methods of laying and specifications for materials; "Bituminous Roads," p. 20, giving brief descriptions of specifications for various kinds; "Road Asphalt in Birmingham, Ala.," p. 129, an informal specification for an inexpensive treatment; "Cost of Tar Binding and Water Binding of Roads," p. 259, a report of English experience; "Some Methods of Preventing Dust on Macadam Streets," p. 397, a rather detailed description of the appliion of tar to streets; "Macadam Roads," p. 436, specifications for the penetration method; "Construction of Asphalt Macadam in Webb City, Mo.," p. 444, a full specification and description of materials and methods of construction and statements of cost in great detail.

In vol. xli: "The Automobile and the Road," p. 155, giving three Tarvia specifications of different cost; "The Ohio State Experimental Road," pp. 179 and 286, brief abstracts of specifications of sections laid with various materials and statements of results; "The Barrington, R. I., Experimental Road," p. 439; "Bituminous Surfaces for City Macadam Streets," p. 285, devoted mainly to oiling processes.

In vol. xl: "Oiling Highways," p. 42, giving specifications; "Oiling Unpaved Streets of a Small City," p. 136; "Cost of Surface Oiling and Asphalt Macadam Roadways," p. 226; "Bituminous Materials in Road Construction and Maintenance," p. 329, giving a general outline of specifications using the mixing method; "The Tarvia Modern Pavement," p. 456, giving specifications for the use of the various brands of this material.

There are still other articles in earlier volumes.

Can Public Service Commission Law Abrogate Existing Franchises

In the year 1880 a water franchise was granted a certain water company, and in it the terms or rates were established and defined and agreed upon by the city and the company. They were not to exceed a certain rate per thousand gallons. The franchise was granted for a term of years, say fifty. Everything pertaining to the granting and acceptance of the franchise was lawful. Thirty years later the state passes a law creating a corporation commission, with powers to fix rates and adjust other matters pertaining to municipal corporations. Could that commission have any jurisdiction over the rates of the company holding such franchise until the fifty years had run out, other than to make the company charge every like consumer a like price under like condition?

JOHN SMITH, Reno, Nev.

There is much difference of opinion as yet concerning the conditions described. The State of Wisconsin solved the problem by making the acceptance of the new law optional with the companies and the terms of the law so favorable that most of the public service corporations in the State have accepted its terms, one of which is that they give up their limited franchises obtained from the municipal corporations and accept an indefinite permit under the State's public service commission. The question has never been definitely decided by a court.

Have our readers any information or any opinions which will aid our correspondent in his study of the question?

FROM WORKERS IN THE FIELD

Manhole Covers With Creosoted Wood Blocks Set to Conform With Pavements

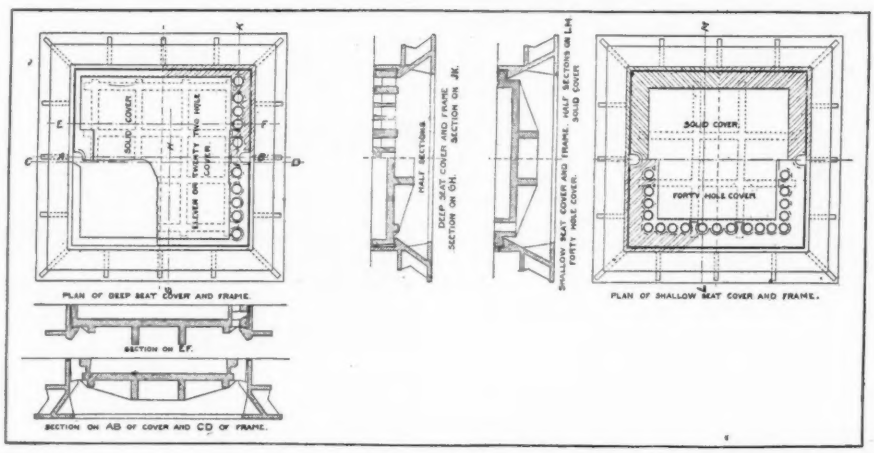
Editor of MUNICIPAL ENGINEERING:

Sir—The ideal pavement for heavy traffic should meet the following requirements:

It should have a smooth, even and uniform surface, of such character as to offer the least resistance to vehicle traction. It should be durable and possess uniform wearing qualities. It should be noiseless from the effect of hoof strokes, the wheel contact on pavement itself or induced rattle and vibration set up in vehicles passing over it. It is desirable that it should not only be clean itself, but easily cleaned of any refuse or litter coming upon the roadway. It should require a small amount of crowning, and form a waterproof surface. It should be durable, easy to repair and the cost of maintenance small.

It should be of such character as to give the most satisfactory construction where junctions have to be made with such obstacles as street railways, manhole covers, etc. Creosoted wood block, now being used very extensively "inside the loop" district in Chicago, fills the above requirements; but, in my opinion, creosoted wood blocks should be uniformly used on manhole covers and between car tracks, in order that the streets be uinform thruout.

It is believed that more satisfactory results might be had in the track paving if the tie rods were turned flatwise and thoroly bedded in mortar, so as to form a part of the paving bed. With a three or three-and-one-half-inch paving block the tie rod space or break could be eliminated by laying the blocks continuously over the tie rods. The greater portion of the wear in track laying comes from the calking in the transverse joints. By laying the blocks lengthwise of the track, the number of tranverse joints would be reduced by fully one-half. In addition to that, those that do occur would be broken. I know of no case where these expedients have been tried. It is believed that some such method should be given a test, at least to prove or disprove the theory. While the property owner does not foot the bill for the track paving, he certainly has a vital interest in the character of the roadway as affected thereby. The


SOLID COVER
SLEEVER OR TWENTY TWO HOLE COVER
PLAN OF DEEP SEAT COVER AND FRAME.
SECTION ON EF.
SECTION ON AB OF COVER AND CD OF FRAME.
HALF SECTIONS
DEEP SEAT COVER AND FRAME
SECTION ON GH.
SECTION ON JK.
SHALLOW SEAT COVER AND FRAME. HALF SECTIONS OR LM.
FORTY HOLE COVER.
SOLID COVER.
FORTY HOLE COVER
PLAN OF SHALLOW SEAT COVER AND FRAME.

DETAILS OF MANHOLE COVER WITH CREOSOTED WOOD BLOCKS SET TO CONFORM WITH PAVEMENT.

depth of block used in track paving in New York is three inches.

On streets which have street car lines, every reasonable effort should be made to get the pavement changed so as to have a uniform pavement over the entire roadway; that is, have the same pavement used inside the tracks as is used outside.

Fig. 1 is a sketch of a proposed plan for a manhole cover and frame. The cover is designed to be set with creosoted wood blocks to form the wearing or roadway surface.

The two types shown embody the following features:

First. The deep seat cover. In this the cover seat is well down in the frame, allowing the cover to rest on its base. That allows the maximum amount of surface to be set with wood block. With a solid cover, only about an inch and a half of cast iron is brought to the surface, around the outside of the cover.

Second. The shallow seat cover. In this the cover seat is near the top of the frame, the cover resting on a flange outside of the recess wall and the cast iron surfaces surrounding the outside of the cover comes to the road surface, being a little over three inches wide, for a solid cover. This type will be less liable to freeze down in winter. It can be adopted so that new covers can be set in the old frames.

For both types ventilating holes are provided where necessary. Instead of being at the center, as in the recessed asphalt covers now in use in some of the boulevard roadways, they are placed around the outside edges, so as to leave the wood block surface continuous. With the deep seat cover and ventilating holes the cast iron surface is about five inches wide. With the solid covers the two "bar holes" would give a small amount of ventilation. If greater ventilation area is required, one or more sides of the cover can be provided with holes. Traffic passing over these rough cast iron surfaces of the present type of cover adds greatly to the total volume of noise and clatter.

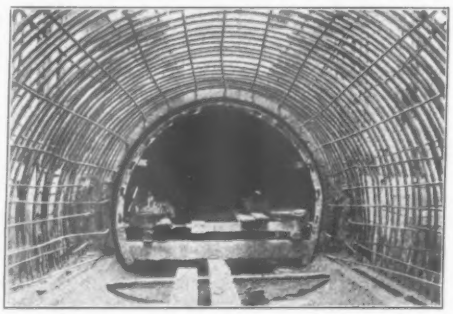
CHARLES K. MOHLER,
Consulting Engineer, Chicago, Ill.

Intercepting Sewer System for New Bedford, Mass.

The Editor of MUNICIPAL ENGINEERING:

Sir—The city of New Bedford is located on two arms of Buzzards bay, known as Clarks cove and the Acushnet river. At the present time all the sewage from the city is emptied directly into the river or cove. These waters have only a small movement, the average tide being about four feet, and the dumping of sewage for many years so close to the city has resulted in a very objectionable and unhealthful pollution.

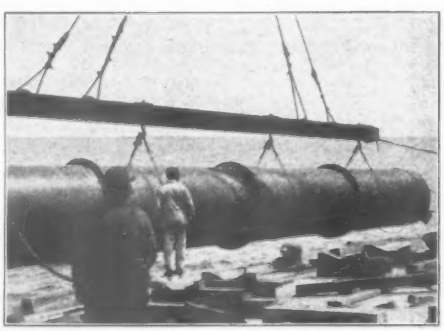
The intercepting sewer, which will take in all the present outlets, is designed to run from the extreme north end of the city southerly along the shore of the Acushnet river for about half its length, thence crossing to the shore of Clark's cove and continuing to the extreme end



REINFORCEMENT OF OUTLET SEWER, NEW BEDFORD, MASS.

of Clarks point, where it enters submerged pipes and runs to an outlet 3,300 feet from land, emptying under 40 feet of water in Buzzards bay. This outlet is so located and is such a distance from land that the prevailing currents and winds will diffuse the sewage and prevent any pollution near the city.

The size of the intercepting sewer will be equivalent to a three-foot diameter cir-



HANDLING 48-FOOT SECTIONS OF OUTLET PIPE SUBMERGED IN BAY, NEW BEDFORD, MASS.

cular section at its northerly end and will be increased in section, as required, for a distance of about four miles, when it will reach a section 7 feet by 7 feet 8 inches of horseshoe shape. This size will be continued for two and one-half miles to the outfall in the bay, the outfall being constructed with two lines of 60-inch cast

iron pipe 3,300 feet in length. All the sewer, except the outfall, will be concrete, reinforced as conditions require. In addition to the main intercepter there will be a 48x50-inch branch intercepter for a short distance on River street, as shown on the accompanying plan.

A small part of the city is too low to be taken directly into the sewer. This section will be accommodated by a separate sewer system which will have its outlet at a pumping station on Cove road.

The pumping station will be equipped with four electrically-driven 8-inch centrifugal pumps, which will pump the sewage up into the intercepter.

The outfall pipe in the bay will connect with the land work at a junction chamber where suitable sluice and tide gates will be installed for governing the flow. The elevation of the sewer is such that high tide will back the sewage up for about two miles along the line, but in no place except at the extreme low end is the land section likely to be under head.

Near the outfall end of the sewer a screen house and grit chamber will be built to take out of the sewage all material which would be likely to settle in the outfall pipe. A screen will also be installed at the pumping station to rid the sewage of foreign material before it goes to the pumps.

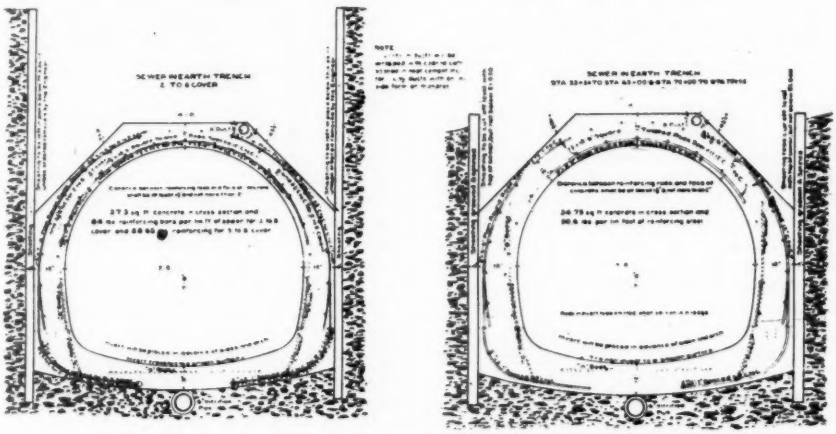
About three miles of the lower end of the work is already under way, consisting of four sections, three being built under contract and one by the city itself. The outfall pipe and outlet in Buzzards bay are nearly completed; the pumping station is about half finished, and about a mile of the 7-foot by 7-foot 8-inch section of sewer is completed.

This 7-foot by 7-foot 8-inch section is built as shown on the accompanying drawings and photograph and is reinforced with ⅝-inch rods transversely and longitudinally. The concrete is all 1:2:4 and is mixed in portable mixers. The side walls are 12 inches, the arch 9 inches and the invert 9 inches thick. The invert is placed first and screened to shape and finished with 1:1 mortar. Blaw collapsible forms are being used for the arches. Very little water is being encountered, and 2-h.p. gasoline pumps are found sufficient to handle it.

One section of work is being carried on by a cableway, one with a Carson machine, and the rest with derricks.

The total work is estimated to cost about $1,600,000. Of this amount the Cove road pumping station will cost about $15,000 and the screen chamber about $50,000.

The work was designed and brought to its present stage by William F. Williams, formerly city engineer of New Bedford. Mr. Williams has recently been appointed chief engineer of the Massachusetts Harbor and Land Commission, but will continue to have a supervision of the sewer work as consulting engineer for the city.



CROSS SECTIONS OF OUTLET SEWER, NEW BEDFORD, MASS.

WALTER N. CHARLES,
Assistant City Engineer,
New Bedford, Mass.

A Study of City Planning

A specially appointed committee of the National Conference on City Planning is to conduct this year a study in city planning, taking an area on the outskirts of a growing city of 200,000 to 300,000 population. A description of the area and the details of the study may be had on application to the secretary of the conference, Flavel Shurtleff, 19 Congress street, Boston, Mass.

MUNICIPAL MATTERS IN COURT

Decision in Grand Rapids Bitulithic Case

The U. S. District Court for the western district of Michigan, southern division, C. W. Sessions, district judge, has just decided the case of Warren Brothers Company vs. The City of Grand Rapids and Edward W. Seamans, enjoining the latter from carrying out their contract for the construction of the Barclay street pavement.

The specifications call for a bituminous macadam pavement, and in the judgment of the court infringe the Warren patent, whose "basic idea is the so-called inherent stability of the mineral aggregate in its composition, which consists of the two elements of density or absence of voids and stability or resistance to displacement, existing independently of the plastic binder." This court, not long before the making of the contract now enjoined, entered a consent decree in Warren Brothers Company vs. The City of Grand Rapids, John Kloote and Henry Vanderveen, declaring that the performance of a paving contract with specifications very similar to the present ones would necessarily be an infringement of the Warren patent. The court expresses the opinion that the difference in the specifications in the two contracts "is more of phraseology than of substance. In the one a resultant product is described, while in the other the process of producing and the constituent elements of substantially the same product are described. Both call for substantially the same mineral elements graded in the same way, except that in the one maximum sized stone of 1¼ inches are to be used to construct a wearing surface 2½ inches in thickness, while in the other maximum sized stone of ¾ inch are to be used to construct a wearing surface 2 inches in thickness. The comparative difference in the maximum sizes of stone to be used thus appears to be slight. Under the evidence it cannot be doubted that by following the process and complying with the requirements set forth in the one, the mineral aggregate having 'A maximum degree of density and low percentage of voids' described in the other will be produced."

Decisions of the Higher Courts of Interest to Municipalities

Incorrect Monthly Estimate Does Not Constitute Grounds for Damages For Contractor.—Under a municipal contract for the construction of a public improvement, providing that the city engineer each month should make a partial estimate of the amount due the contractor, 80 per cent. of which should be paid the contractor at that time, the engineer is the arbiter of how much should be paid as the work progresses, and the contractor cannot recover damages because such estimates are incorrect. Manerud et al. v. City of Eugene (Ore.) 124 P. R. 662.

Responsibility of City for Defect in Street—Sufficiency of Notice.—A city's duty to repair defects in a street arises only after actual notice of their existence, or after such a lapse of time as would justify the imputation of negligence, if the defect had not been discovered. A police officer's knowledge of a defect in a city street is not notice to the city, unless it is his duty to report or make provisions for the correction of the defect, or to look after or control the making of repairs or the removal of obstructions. Under Ky. St., Sec. 2885, providing that it shall be the duty of police officers in cities to remove all nuisances in the public streets, parks and highways, it was the duty of a policeman, on obtaining knowledge of a dangerous cave-in in a street, to guard the same in order to prevent injury thereby, and hence the policeman's knowledge thereof was notice to the city; the word "nuisance," as there used, not being limited to a physical obstruction placed in a street, but including anything that "worketh hurt, inconvenience or damage."—City of Louisville v. Lenehan, 149 S. W. 932.

Municipal Corporation is Not Liable in Its Governmental Capacity for Misconduct of Its Officers.—A municipal corporation, when engaged in the preservation of the peace, public health, maintenance of good order, and the enforcement of the laws for the safety of the public, exercises governmental functions, and is not liable for misconduct of its officers, but where a municipal corporation is exercising those powers and privileges peculiarly for its benefit it is liable.—Smith's Adm'r v. Commissioners of Sewerage of Louisville (Ky.) 143 S. W. R. 3.

SEWERS AND SEWAGE DISPOSAL

Reports of Experience with Concrete for Sewers.

Following are some notes of experiences with concrete for sewers, which include also some data not reducible to tabular form:

Alameda, Cal., has had concrete sewers in use for from fifteen to twenty-five years and has had some disintegration and some failures, especially in the older sewers.

Colton, Cal., reports some disintegration in concrete sewers.

Los Angeles, Cal., reports some disintegration in old pipe sewers, having used concrete at intervals since 1875.

San Francisco, Cal., uses monolithic concrete construction for sewers, as shown in Table III, and has several types for large storm sewers, some of which cost as much as $75 a foot. Brick sewers have not been used in recent years on account of the high cost of brick. One concrete outfall sewer reinforced with expanded metal on a wooden pile foundation extending into the bay in about 6 feet of water, was shaken by the earthquake and broke transversely in about ten places within 100 feet. The reinforcement is considered to have been inadequate.

New Haven, Conn., has built some wide and shallow sewers with heavily reinforced covers, and two 36-inch circular and egg-shaped overflow sewers. Natural cement concrete sewers were built generally from forty to fifty years ago, but this use was abandoned forty years ago because they were unsuitable. There has been no trouble with the recent concrete sewers.

In Atlanta, Ga., concrete sewers by contract cost more than brick sewers, but most concrete sewers are built by county jail prisoners, the city furnishing the materials. Sewers have velocity of flow of 10 to 12 feet a second, and are thus kept perfectly clean. There is no appreciable leakage or abrasion as yet.

There has been much comment over a concrete pipe sewer some forty years old at the stockyards in Chicago, Ill., which was found to be almost wholly disintegrated when dug up recently.

Indianapolis, Ind., has used continuous plain and reinforced concrete and reinforced concrete pipe for sewers. The plain concrete was observed to have heavy, irregular coating of efflorescence, obstructing the flow, which formed when only ground water was flowing in the sewer. There was much leakage into this sewer in pipe sections, due to heavy pressure of ground water and joints not sufficiently strong to resist it.

South Bend, Ind., has used concrete sewers for many years, with no failures reported.

Vincennes, Ind., has concrete pipe uniformly 2⅞ inches in thickness, reinforced with triangle mesh and tongue and bevel joints filled with cement mortar. The rule for thickness is 1 1/12 inches per foot of diameter, with minimum above stated.

Sioux City, Ia., reports concrete sewers satisfactory, but requiring closer inspection to get good material and finish and to keep forms in place long enough.

Louisville, Ky., uses plain monolithic concrete in sewers 24 to 60 inches in diameter and reinforced concrete in sewers 39 inches to 15 feet 6 inches in diameter. In the only pipe sewer contract the pipe was required to be surrounded with additional concrete and was finished monolithic. The commission has constructed no brick sewers. All leaks were remedied or reduced to satisfactory minimum before expiration of guarantees. An inconsiderable amount of efflorescence has been observed.

New Orleans has some plain concrete sewers, 4 to 6 feet in diameter, of same section as brick and costing slightly less. Thin concrete is feared in the local soil, but thick sections are used without hesitation. Large drainage canals are lined and covered with reinforced concrete. The surface of the concrete has softened at one point where the soil through which it is laid is supersaturated with gas plant wastes; sewer eight years old. No other trouble anywhere.

Bangor, Me., reports crushing of some concrete pipe not properly seasoned before laying.

Portland, Me., reports some 1,000 feet

of disintegrated concrete pipe replaced.

Cambridge, Mass., uses plain and reinforced concrete in sewers, both continuous and in blocks, and various combinations with each other and with brick. Concrete usually costs less than brick. A sewer laid in 1895, recently examined, is as perfect as when laid. Used in sewers as small as 18 inches diameter.

New Bedford, Mass., reports satisfactory experience with concrete sewers, and will build an intercepting sewer, with an outlet three-quarters of a mile from shore, in 40 feet of water.

Springfield, Mass., uses plain concrete in sewers with 8-inch walls, the cost being about $6 to $7 per cubic yard.

West Newton, Mass., has nearly 5,000 linear feet of 16x24 to 20x30-inch plain and reinforced concrete sewers, constructed prior to 1908, most of them having brick inverts.

Worcester, Mass., uses both plain and reinforced concrete sewers, laid continuously, with shells thinner than brick sewers. These sewers are of large size where acids from factories are largely diluted, and no disintegration of concrete has been observed.

Kalamazoo, Mich., builds all its sewers through its engineering department, and they cost less than by contract. Most concrete sewers are for storm water only, but one sanitary sewer was built last year. Plain concrete is laid continuously, as shown in section, Fig. 4. About a mile of 42 to 30-inch reinforced concrete is in use.

Duluth, Minn., uses concrete only in outlet sewers. It has some concrete drains over twenty years old, in which no failures have been reported.

In Minneapolis, Minn., concrete sewers cost 25 to 60 per cent. less than brick sewers. There are sixteen miles of them in use, some thirty years old, of 33 to 120 inches diameter. There have been no failures and there is less leakage than in brick sewers.

St. Paul, Minn., has used reinforced concrete pipe, but is now using monolithic reinforced concrete, which is somewhat cheaper than other materials. There have been some failures on account of poor materials and workmanship, but no disintegration from external action worth mentioning.

Kansas City, Mo., has opened its specifications to vitrified clay and plain concrete pipe in sizes below 30 inches, and to monolithic concrete and reinforced concrete pipe in sizes above 30 inches. Each class of material has been used by low bidders, competition being keen. Brick cannot compete in cost with the other materials. Reinforced concrete sections of special shapes and strength are used, one such being shown in Fig. 7, as used on O. K. creek in railroad yards.

In South Omaha, Neb., cost of concrete sewers runs 10 to 20 per cent. less than brick in sizes 24 inches or over. One failure destroyed 120 feet of 6-foot sewer with 9-inch shell. It was caused by poor foundation and an earth fill not anticipated when design was made. There is slight disintegration of sewers carrying discharge from meat packing plants, and there is a slight growth in the same sewers.

Dover, N. H., reports failure of some poorly made concrete pipe sewers less than fifteen years old.

Niagara Falls, N. Y., uses reinforced concrete pipe and monolithic concrete at about same cost as brick.

Rochester, N. Y., lines its intercepting sewers with brick, to avoid action of sewage, etc.

Cincinnati, O., has constructed but one plain concrete sewer, and one reinforced concrete sewer is about to be constructed. Three-ring brick is used, and a thickness of 8 to 14 inches in reinforced concrete. The plain concrete sewer, 6 feet diameter, has 9-inch shell. The 8-foot brick sewers average $1.57 per linear foot per foot of diameter, the average being based on ten contracts and twenty bids, with sizes varying from 2½ to 13 feet diameter. An 8-foot sewer cost $12, or $1.50 per linear foot per foot of diameter, and a 6-foot sewer cost $1.67. The 6-foot plain concrete sewer cost $7 a foot, or $1.17 per linear foot per foot of diameter.

Cleveland, O., constructs continuous plain and reinforced concrete sewers and has a small amount of Parmley reinforced block sewers. Reinforced concrete is a little cheaper than brick, though some contractors bid lower on brick than on concrete on the ground that there is less risk in the use of brick.

Dayton, O., has adopted a rule to use concrete in storm water sewers only in diameters of 30 inches or over. Vitrified pipe is used up to 15 inches and double-strength vitrified pipe from 15 to 30 inches, with 3-foot lengths. Two sanitary trunk sewers were built of plain concrete and one large storm sewer of reinforced concrete. There has been some slight attrition in flow line of storm sewers, due to scour, and all new concrete sewers have 120 degrees of the invert lined with vitrified brick. A 9-foot reinforced concrete sewer cost $6.38 per linear foot, exclusive of trenching and appurtenances. There have been some unimportant failures in arches of old two-ring brick sewers. Plain concrete sewers have shells of thickness one-eighth of diameter, with minimum of 6 inches.

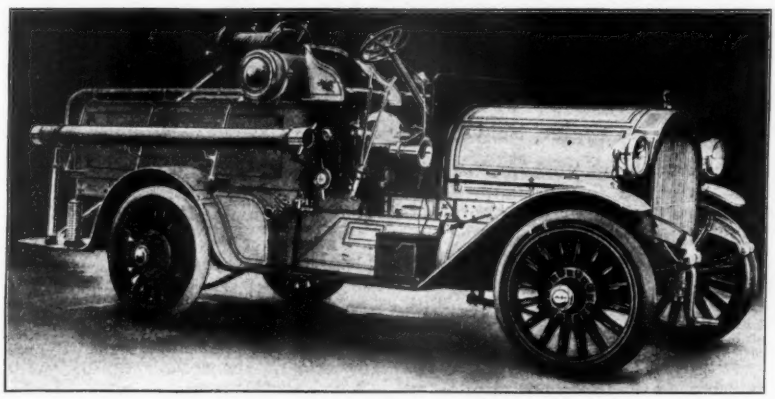
MOTOR VEHICLES

The Minneapolis Specifications for Fire Engine

The illustration of this article shows a self-propelled, four-cylinder, 90-h.p. combination motor pumping fire engine with chemical equipment and hose carrier as used by the city of Minneapolis, and made by the Nott Fire Engine Company.

This engine exceeded the severe test required by the city.

H. Tuttle, who has spent twenty-five years as master mechanic of the fire department, was probably the first master mechanic in the United States who demanded the same efficiency of the gasoline pumping engine as of the steam fire engine.



MOTOR DRIVEN FIRE ENGINE
Owned by the City of Minneapolis.

Embodied in the specifications, under the head of "Pump Capacity," was the following:

"Rated capacity of pumps to be not less than 500 gallons per minute, as per pump requirements. Pump may be of the maker's own design, but its rated capacity must be governed by the horsepower of the engine computed at 1,000 feet piston speed per minute by the A. L. A. M. rating standard horsepower formula, and said rated capacity to be ten gallons per minute for each horsepower, which is found by computing the power of the engine by said formula minus 5 per cent. for power consumed in slip. The rated capacity thus obtained must be delivered at a net pressure of 120 pounds per square inch at the pump, or its equal, by which is meant that the product of the gallons pumped and the pressure of the pump are equal to the rated capacity multiplied by 120. The number of gallons pumped to be determined by Pitot gage at the nozzle and computed by the standard formula of the National Board of Fire Underwriters, which must be done during a continuous run of not less than fifteen minutes and Pitot gage reading to be taken every thirty seconds, and the average of all readings to be computed to determine the number of gallons delivered; also the average of all tests to be taken to determine the actual efficiency of work done. Pumps of the rotary design must be constructed so as to automatically take up the space between the circular part of the case and rotating parts which so rapidly increases in volume when dirt or sand is in the water."

The test was made, drafting water 12 feet thru 20 feet of 4½-inch suction hose.

The duration of each test was fifteen minutes. Average of all pressures taken to determine the actual amount of work done, and the average of all tests computed to find the actual efficiency of all work done, as is shown by the following table giving results of the tests:

Test No.	No. and Length of Lines.	No. and Size of Nozzles.	Av. Engine Pressure.	Av. Nozzle Pressure.	Gals. Pumped.	Units of Efficiency.
1	.....1—300 ft.	2—1 in. S. B.	130.5	75.4	514	67,077
2	.....2—300 ft.	2—1⅛ in. S. B.	113.	52.6	544	61,472
3	.....1—500 ft.	1—1¼ in. S. B.	186.9	57.5	350	65,415
4	.....1—500 ft.	1—1⅛ in. S. B.	191.	65.5	303	57,873

Average units of efficiency more than required, 10,397.

MOTOR CYCLE SQUAD, NORTH SIDE PARK POLICE, CHICAGO.

Motor Cycles in Police Service

The accompanying photograph shows three of the five men in the motorcycle squad of the police department of the Lincoln Park commissioners.

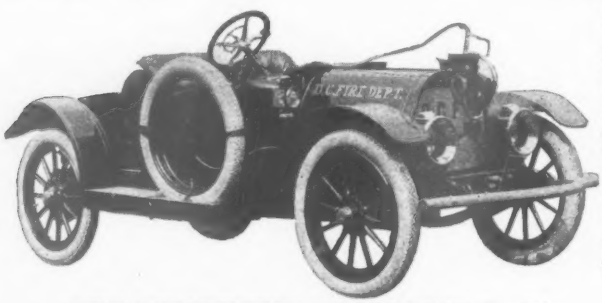
These machines patrol the entire length of the North Side boulevards and parks, principally to regulate the speed and other violations of motor vehicles, such as smoking lights and defaced number plates.

The machines are the two-cylinder 7 h. p. Indian type and capable of a speed of 70 miles on the road.

The experience of Captain Chas. E. Shaw has been that this is the most effective way of handling the classes who violate the law.

Deputy Chief's Car in Washington's Fire Department

The fire department of Washington, D. C., has recently added a new Warren car for one of its deputy chiefs, which is a 12-40 special roadster with special body, Firestone demountable tires, Stewart speedometer, muffler cutout, searchlight gas tanks, water-jacketed Stromberg carbureter, extra heavy bumper, Hanna gas lighter, combination side and tail lamps, with Exide storage battery and switches convenient to each passenger. The car has a large gasoline tank and leather trunk and a 14-inch New Departure gong with rope pull, being the only car in the department using this bell.



FIRE DEPARTMENT, WASHINGTON, D. C.
Car for Deputy Chief.

CIVIC BEAUTY

EDITED BY MYRON H. WEST

Waterproofing of Swimming Pools

BY LINN WHITE, ENGINEER, SOUTH PARK COMMISSION, CHICAGO.

Public swimming pools are receiving increasing attention thruout the country. Park boards, during the past year, have installed hundreds of public pools, and plans are under way calling for the construction of fully twice as many public bathing pools and natatoriums for the year 1913.

The South Park Commission, of Chicago, has many of these pools in operation and will construct more during the coming year. At the pools listed in the following table are available 65,000 free bathing suits and 85,000 free towels for the use of the public.

		DEPTHS		EQUIPMENT			
	Dimensions Feet	Maximum	Minimum	Dressing Booths	Shower Baths	Spring Boards	Diving Towers
Mark White Square	65.5x107	9 feet	3 feet	192	10	2	1
Armour Square	50 x 88	8 ft. 6 in.	3 feet	90	8	2	1
Cornell Square	76 x 60	9 feet	2 ft. 6 in.	85	8	2	1
Davis Square	70 x100	8 ft. 6 in.	3 feet	125	8	2	1
Russell Square	45 x 86	9 feet	3 feet	...	10	2	1
Sherman Park	80 x150	9 feet	2 ft. 9 in.	209	20	2	1
Ogden Park	80 x150	9 feet	2 ft. 6 in.	224	10	2	1
Bessemer Park	94 x140	9 ft. 6 in	2 feet	133	16	2	1
Palmer Park	92 x140	9 feet	2 ft. 6 in.	228	12	2	1
McKinley Park	34,800 sq. ft.	8 feet	0	206	16	3	..
Calumet Park	Lake Michigan Beach.	.....		100	..	..	Raft

The swimming pool of Park No. 4, or Fuller park, at Forty-fifth, Forty-sixth and Princeton avenue, was designed by D. H. Burnham & Co. and is said, on good authority, to be one of the largest and most carefully planned public swimming pools in the world.

This pool is built on an elevated terrace, and the footings, walls, piers, columns, steps, platforms, floors, fountains, approaches, balustrades, parapet walls and pedestals are made of stone concrete.

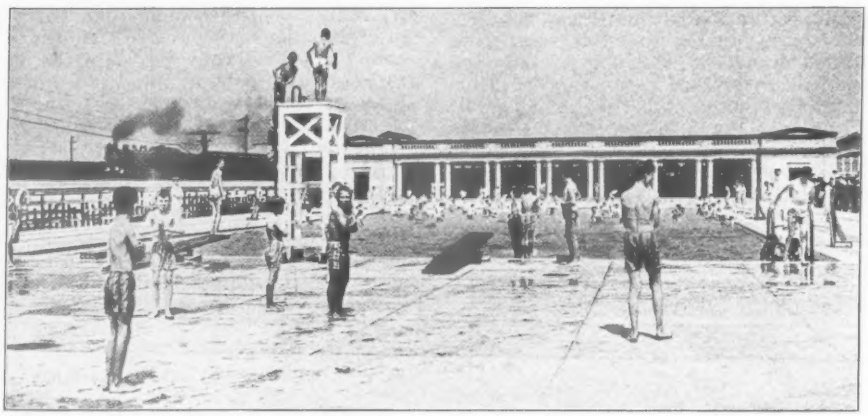
The swimming pool is constructed of terra cotta and "Ceresit" waterproofed concrete. The requirements for a perfect means of preventing the penetration of water thru the walls and bottom of a swimming pool are not only that the waterproofing material used in the concrete mass absolutely prevents the penetration of any moisture whatever, but that the waterproofing material used shall not affect the original strength of the cement. In the construction of the swimming pools in the South Park District, we do not merely waterproof surfaces as was formerly the universal custom, but we waterproof the entire concrete mass, so that, in event of the surface being chipped or scratched, the waterproofing material still keeps any moisture or water from penetrating thru the mass. We do not use a waterproofing powder but a white Ceresit paste. The concrete mass is in all cases tempered quite wet. The amount of Ceresit mixed with the gaging water is increased or decreased according to the water pressure. Where the latter is high, 12 parts of water are mixed with one part of Ceresit. Where the water pressure is low, 16 or even 20 parts of water may be used. When the concrete mass is waterproofed, of course, a waterproofed cement

mortar is not required, which means the saving of labor for applying a cement mortar coat and also the cost of material for the same.

The small circular islands and brick border in connection with the cement paving around the swimming pool are paved with selected, vitrified standard size red brick set on edge in pattern and bedded in Portland cement mortar with the joints filled with cement grout. The concrete floors, staircases, steps, platforms, gutters, curbs, borders, etc., are finished with a granolithic top dressing or wearing surface one inch in thickness.

The gymnasiums, men's and women's toilets, shower rooms and lobbies are all faced with white enameled terra cotta. The ackroters on the east and west gable ends of the main building are made of terra cotta, with a green sand blasted enamel surface finish which matches the roofing tile. The inner court pergolas adjacent to the main and gymnasium buildings have an open timber roof consisting of beams and purlins.

The assembly hall has a paneled ceiling between the two upper purlins. The concrete walls of this hall are wainscoted with flush red birch wood. The gymnasium balconies are built and suspended from the trusses and purlins by suspension rods. The lunch room counter is of combination wood and marble construction.



FULLER PARK SWIMMING POOL, CHICAGO.

Landscape Beautiful: A Town Asset

BY GEORGE BLACKSTONE IRVING.

While in an Illinois town of less than 2,000 inhabitants, the writer met a business man who had recently moved into the community. Inquiry as to what influenced him to do so drew from him information that he accidentally came to a Fourth of July celebration, and while attending it was so favorably impressed with the beauty of the town's landscape that he moved his own family and that of his son to the place and purchased at once.

For centuries the city of Paris has been accepted as the world's playground. Some of its chief attractions are its public parks and gardens, its boulevards and pleasure grounds, its architecture and landscape vistas. Paris has learned well the lesson of the industrial value of civic beauty as an investment. Napoleon rebuilt Paris with inhabitants objecting, but the present citizens now appreciate that the landscape charms of that city bring a trade worldwide, worth millions of dollars, annually. As a result of this appreciation the municipality has been authorized to borrow $175,000,000 for further beautification as an investment. A part of this, $47,000,000, contemporaneous with the recent labor troubles of Paris, was oversubscribed thirty-nine times.

The towns of the United States have recently awakened to the importance of this great asset. The federal government in Washington has endorsed the elaboration of George Washington's plan for beautifying the city named after himself, and it is spending millions of dollars to realize it; Boston is busy with its city plan; Chicago has one which startled Europe when displayed at the City Planning Convention in London; Oklahoma City bonded itself recently for $400,000 for boulevards, Cleveland and Cincinnati likewise for millions of dollars, and Portland, Ore., recently accepted plans prepared by a landscape architect, which will cost millions to execute. Redlands, Cal., has voted $80,-

000; San Diego, $1,000,000; Houston, $150,000, all to be expended for landscape schemes.

The next step is to consider how to realize an industrial investment of this sort for one's home town.

First, there must be an educational campaign organized, not only with able men and women, but for a long siege if necessary. The work of converting the citizens of the community to the great value of a landscape plan is not insignificant and must not be ignored.

Educational work in the papers is admirable. The work other towns are doing must be described; for example, such as that of Kalamazoo, Mich., which for a long period endeavored to get factories, but un-

GEORGE BLACKSTONE IRVING.

successfully along old lines, and therefore decided to make Kalamazoo a better city to live in. Within two years thirty-two new industries located there without a dollar of bonus.

A public holiday for town cleaning will pay. Prizes for the removal of pasteboard advertisements on buildings and telegraph poles cleaned up the city of Red Wing, Minn. Bay City, Mich., realized results by the ladies publicly announcing a tour en masse of alleys and by-ways. Photographs of undesirable spots reproduced in the newspapers turn the trick often. Spokane, Wash., decided to do this. A newspaper representative approached the owner of one of the beauty spots (?) with a request to be allowed to take a photograph, and when the owner said he didn't care, the newspaper representative replied that, if he didn't care, he would reproduce a half-page of the undesirable yard. Then the owner exclaimed, "O, don't do that; I will clean it up."

Prizes for clean back yards bring results, as also for gardens and lawns. Renting vacant lots and planting is the plan of Los Angeles. Arbor day, when the Commercial Club gives away trees, flower seeds and bulbs, should not be overlooked. Chicago, on its Arbor day, sold 300,000 mulberry sprouts for one cent each to the school children.

A garden school arouses the children very successfully. Information can be secured on this subject from the Fairview Garden School, High street, Yonkers, N. Y. A junior civic league has awakened the children of Morristown, N. J.

An attractive business section is always an advertisement. So far as possible, teams should be prohibited hitching on the main business street, and when such an ordinance is passed facilities should be otherwise provided. The National Humane Alliance, Charities Building, New York City, will give a bronze-trimmed, red granite fountain to any town paying the freight and set-up. The town that first prohibits horses on certain streets, allowing automobiles, will secure advertising and a clean street.

Electroliers or chandelier lighting of the business section is worth a great deal more than it costs. Des Moines, Iowa, has almost five hundred of these chandelier lights, the downtown district all night glowing brilliantly. But these lights might well be turned out Sunday evening. Flushing Main street is also advisable. A wide-awake town not only paves its business section, but also its downtown alleys (and keeps them clean).

Roadside landscape work should be more generally encouraged. America is years behind Europe in this regard. Rural landscape gardening deserves immediate encouragement by state and nation, and costs very little money.

The town planning act in England has made town landscape work compulsory in that country. France also has such a law.

It remains for a commercial club to promote a local landscape plan. Ask your state agricultural college for a landscape professor to visit your city. Then a professional landscape architect should be employed. Boulder, Col., which continuously employs one landscape gardener and sometimes has two, paid Mr. Olmsted, of Boston, $1,000 for a few days of his help. A few hundred dollars spent by a town for a landscape plan will hasten the bonding of the community for the means to execute the plan.

While the larger landscape scheme is being sought, a lesser one may be attempted in shade tree culture under the auspices of a shade tree commission operative by city ordinance, which gives their exclusive care to this commission, planting, pruning, spraying, watering, protec-

tion, removal, etc. East Orange, N. J., affords a good example.

The suggestion is offered at this time of a municipal nursery to supply the proper shade trees for a given locality. This department would be practicable under a landscape gardener or shade tree commission. When neither is available, such a department in connection with the public schools would be a form of manual training, while also a landscape asset.

A criticism is offered that shade trees are planted indiscriminately and without knowledge of soils. In general high and low soils obtain. Following nature's planting is advisable. Typical of lowland shade trees are hard maple, white elm, American linden or basswood, sycamore, yellow birch; of upland are oak, hickory, etc. The box elder is in disfavor. For ornamental trees use the hawthorn, European alder and white birch, Norway spruce, European larch, silver and white spruce, and for general planting, the white pine. The mulberry is a friend of birds, and birds are friends of men. For southern states the magnolia, cypress and Carolina poplar are popular.

City Planning

BY JENS JENSEN, MEMBER OF SPECIAL PARK COMMISSION AND CHAIRMAN OF CITY CLUB COMMITTEE ON CITY PLANNING, CHICAGO.

Every village and every city has some natural features which, if we have eyes to see, can be developed so as to produce individuality and character. But usually generations pass before we discover the fact that there has really been something beautiful that should have been incorporated in the town to give it the individuality and character which we prize.

I call your attention to the wonderful opportunity of the city of Seattle, Wash., surrounded by the most beautiful environment that perhaps has been given to any of our American municipalities. And this wonderful environment was not considered at all in laying out the city.

Each city with its good and bad expressions should stand as a true expression of the character of its people. Each city should have its peculiarities, its own interests, its own expressions, rather than become a copy of some other town, developed on a cut-and-dried plan.

Just now city planning is rapidly rising on the wave of popular enthusiasm. It has taken our cities by storm. A new profession has come into life. Plans are rapidly being made and the zealous public, gazing upon their depiction of gayly colored parks, wide boulevards and ornate bridges, are fired with the desire to make all American municipalities such pleasing pictures as the clever draughtsman has represented on paper.

To cut a broad street thru a city is one thing, to have the sides of it lined with buildings of harmonious facade is another; and on this last depends a satisfactory working out of the plan.

To build civic centers and magnificent boulevards, leaving the greatest part of the city in filth and squalor, is to put on a false front, which vitiates the whole atmosphere of the town.

A city should first of all be homelike. May not this be secured by a system of regulation?

Such regulation of the city might be in the hands of a new department—a department of civics, or civic beauty. Such a department might be made up of an engineer, an architect, a good business man, a sculptor, a landscape gardener, etc. The members should be appointed for a period of not less than six years, one member

JENS JENSEN,
Member Special Park Commission.

retiring each year, and their removal from office should be subject to judicial inquiry.

Such a department should pass upon the transportation facilities, depots and freight terminals, harbor and river development, etc. Designs for all municipal buildings, building sites, and bridges should be submitted to it for approval.

Thru conference with the civic board of control, each new public building erected would be constructed with a view to improving the city as a whole. One of the most important duties of this board would be to develop the school as a neighborhood center.

ORGANIZATIONS & INDIVIDUALS

American Society of Municipal Improvements

The American Society of Municipal Improvements held one of its most satisfactory conventions at Dallas, November 12 to 15. Several familiar faces from the North and East were missing, but the Southern and Southwestern attendance was large enough to make up.

The principal subjects for discussion were the specifications presented by the sub-committees of the committee on standard specifications, particularly the new set of specifications for sewer construction, presented by a committee consisting of E. J. Fort, Rudolph Hering and A. J. Provost, Jr., and the proposed Amalgamation with the Society for Standardizing Paving Specifications. The latter was presented in the form of a resolution of the S. P. S. on the subject and a tentative report of a committee from that organization whose membership includes several members of both associations. The convention was unanimously in favor of amalgamation, but not altogether on the lines of the report, and a committee, all three members of which are members of both societies, was appointed to attend the meeting of the S. P. S. at Pittsburgh and develop a plan for consolidation. Pending the result of these deliberations, and in the absence of the chairmen of the general and several of the sub-committees on standard specifications, the adoption of the specifications presented was postponed until the next meeting.

An excellent list of papers and committee reports was presented, including papers on "Effect of Traffic on Bituminous Pavements" and on "Testing Bitumens," by Isaac Van Trump, engineering chemist, Chicago; "The City Economic," by Louis L. Tribus, consulting engineer, New York; "The City Engineer and Health Board," by James N. Hazlehurst, consulting engineer, Atlanta, Ga.; "Imhoff Tanks," by Prof. Henry N. Ogden, Cornell University, Ithaca, N. Y.; "The Durability of Grouted Granite Pavements," by W. A. Howell, engineer of street department, Newark, N. J.; "Sewerage and Sanitation," by E. L. Dalton, Dallas, Tex.; "Thermal Effects on Cement-Filled Brick Pavements," by James E. Howard, of the U. S. Bureau of Standards; and others.

Committee reports of note were those on "Standard Method of Traffic Recording," J. W. Howard, chairman; "Sewerage and Sanitation," A. F. MacCallum, chairman; "Standard Forms for Municipal Utilities," A. P. Folwell; "Municipal Legislation and Finance," Maury Nicholson, chairman. President E. A. Kingsley presented a valuable annual address.

Membership of all classes is now over 400.

The officers elected are: President, Benjamin E. Briggs, city engineer of Erie, Pa.; vice-presidents, Edward H. Christ, of Grand Rapids, Mich.; W. A. Howell, of Newark, N. J., and A. F. MacCallum, of Hamilton, Ont.; secretary, A. P. Folwell, of New York; treasurer, E. L. Dalton, of Dallas, Tex. Wilmington, Del., is the next convention city.

The Municipal Art League of Chicago

At a recent meeting of the Municipal Art League, Chicago, Henry Ericsson, commissioner of buildings, city of Chicago, outlined a plan for the separation of business and residential territory.

Mr. Ericsson believes that the streets where the car lines are located are the logical normal streets for business development, and that the alleys immediately back of these streets should be the recognized boundaries between the residence and business areas of third classification of territory. Such boundaries, when once established and fully recognized, would give the residents security against unwelcome encroachment of business, and would insure the business houses along the car line having permanently contiguous to them a population which would be adequate for their support. The principle involved in this plan is far reaching and seems to be the only logical method by which homes can be maintained on a satisfactory basis within the city limits of Chicago.

The Municipal Art League was organized to initiate and support opportune

movements for civic improvement, and to anticipate and oppose such influences as threaten to check civic art. The league is at present devoting itself to the following matters:

1. Better street lighting.

(a) Maximum use of underground conduits in place of unsightly overhead wires and poles.

(b) Use of new official design lamp-posts, which the league has helped to secure.

(c) Exhaustive experiments on different methods of street lighting, and the adoption by the city of their results in future contracts.

2. Tree planting in the streets of the city and the extension of the power of the city forester.

3. Enforcing the smoke ordinance by co-operation with the smoke inspector.

4. Enforcing the bill-board ordinances regulating street signs.

5. Consolidation of other improvement organizations, and consequent co-ordination and centralization of activities.

6. Beautification of public school grounds and buildings.

7. Great powers for the official art commission.

8. Commencing on parts of the midway plan.

9. Construction of sections of river and lake-shore driveways.

10. Exemption from taxation of the Ferguson sculpture fund by act of legislature.

11. Erection of an out-door theater in the south parks.

12. Festivals and pageants in the parks.

The officers are: President, Ralph Clarkson; vice-president, Lorado Taft; secretary, Kenneth Sawyer Goodman; assistant secretary, Louis A. Damon; treasurer, Charles L. Hutchinson.

Minneapolis Business Association.

The Minneapolis Civic and Commerce Association has now got so far along in its practical development as to be able to issue a report of the first ten months of its public service. This report is an outline of work done up to October 8 last.

The Minneapolis Civic and Commerce Association was organized December 9, 1911, as a result of the consolidation of the association and Publicity Club, public affairs committee of the Commercial Club, and the Minneapolis Traffic Association. A summary of the work of the new body, which started with a membership of over 2,000, shows activities in smoke abatement, trade extension, improved paving, bridges and street lights, reduction in assessment of the working class section of the city, improvement of local health conditions, promotion of industrial development, participation in national convention service, and establishment of service for investigation of charities.

The president of the Minneapolis Civic and Commerce Association is Arthur R. Rogers. Its secretary is Howard Strong.

Technical Associations

Strenuous efforts are being made to bring out the greatest possible attendance to the Pittsburgh cement show, Exposition hall, December 12 to 18. In addition to the elaborate displays by exhibitors, special exhibits will be installed by the Carnegie Technical Institute of Pittsburgh, as well as by the University of Pittsburgh. These exhibits will be educational in nature and based upon the courses offered by these two institutions in concrete construction, and will also show the results of tests and investigations conducted. In addition to these two displays there will be elaborate educational exhibits by the Association of American Portland Cement Manufacturers, the Bureau of Standards of the Department of Commerce and Labor, and by the Pittsburgh Chapter of the American Institute of Architects in co-operation with the Pittsburgh Architectural Club.

The American Institute of Architects will hereafter issue its journal monthly instead of quarterly, and will extend its field to cover articles and discussions beyond those pertaining to the proceedings of the organization. Glenn Brown, secretary, Octagon Building, Washington, D. C., will have the assistance of committees in obtaining and preparing the additional material required.

On November 14 John A. Britton, vice-president and general manager of the Pacific Gas and Electric Co., and member of the executive committee of the National Electric Light Association, delivered an illustrated lecture on the systems and service of his company, and the remarkable developments in electrical power transmission on the Pacific coast, before the national and local electrical engineering societies, at the Engineering Building, New York City.

The committee on down-town streets appointed by the Chicago Association of Commerce has outlined a subway improvement policy, and proposes to begin in the congested business center of the city with funds of the municipality now available for that work, being its share of the profits of the local traction companies, these central subways to be so constructed as to form a link in a larger system to be developed later as recommended by Bion J. Arnold. The committee lays

stress upon the need for utility galleries, that the tearing up of street pavements for repair work on pipes and wires may be diminished. It further urges that immediate revision of car routing in the loop district and the establishment of ample through routing of surface and elevated cars be given consideration.

The Chamber of Commerce of the United States is rapidly developing its plans for co-ordination of the business organizations of the country and relating them to like organizations in other countries. Its by-laws governing initiative and referendum of questions arising in the affiliated organizations have just been issued and meet the demands thoroughly well.

Technical Schools

The following non-resident lecturers in highway engineering at Columbia University have been appointed for the 1912-1913 session: John A. Bensel, New York state engineer; William H. Connell, chief bureau of highways and street cleaning, Philadelphia; Morris L. Cooke, director department of public works, Philadelphia; C. A. Crane, secretary the General Contractors' Association; W. W. Crosby, chief engineer to the Maryland Geological Survey and consulting engineer, Baltimore; Charles Henry Davis, president National Highways Association; A. W. Dow, chemical and consulting paving engineer, New York City; Walter H. Fulweiler, engineer research department, United Gas Improvement Company; John M. Goodell, editor-in-chief *Engineering Record;* D. L. Hough, president the United Engineering and Contracting Company; Arthur N. Johnson, state highway engineer of Illinois; Nelson P. Lewis, chief engineer board of estimate and apportionment, New York City; J. C. Nagle, professor of civil engineering and dean of the school of engineering, Agricultural and Mechanical College of Texas; Harold Parker, first vice-president Hassam Paving Company; H. B. Pullar, assistant manager and chief chemist, American Asphaltum and Rubber Company; J. M. F. de Pulligny, ingenieur en chef des Ponts et Chaussees, et directeur mission Francaise d'Ingenieurs aux Etats-Unis; John R. Rablin, chief engineer Massachusetts Metropolitan Park Commission; Clifford Richardson, consulting engineer, New York City; Philip P. Sharples, chief chemist Barrett Manufacturing Company; Francis P. Smith, chemical and consulting paving engineer, New York City; Albert Sommer, consulting chemist, Philadelphia; George W. Tillson, consulting engineer to the president of the borough of Brooklyn.

Personal Notes

Arthur C. Freeman, Jr., consulting engineer, Norfolk, Va., is making survey to show and mark by concrete monuments the right-of-way of the Chesapeake and Albemarle canal, one of the most important links of the inland waterway system connecting Albemarle sound and Chesapeake bay.

Oscar Sanne, formerly structural engineer in the bridge department of Chicago, is now in private practice at 1633 Monadnock Block, Chicago, as a bridge and structural engineer.

Hubert A. Stevens, of Joliet, Ill., will supervise the extensive new paving work of Corpus Christi, Tex.

Charles L. Dunford, of the Toronto city engineer's office, has been appointed assistant city engineer of London, Ont.

William F. Morse, 90 West street, New York, consulting sanitary engineer, is also consulting engineer for the Atkinson-Morse Co., which installs Morse garbage and refuse destructors, and for the Griscom-Russell Co., which is introducing the English Sterling destructor in American cities on the strength of its excellent record abroad. Mr. Morse is author of the most complete American book upon "The Collection and Disposal of Municipal Waste."

David White has been promoted to the position of chief geologist of the U. S. Geological Survey, to succeed Waldemar Lindgren, who goes to the Massachusetts Institute of Technology. He is succeeded by Dr. F. L. Ransome in his former position as chief of the section of economic geology of metalliferous deposits.

Sanford E. Thompson, M. Am. Soc. C. E., consulting engineer in structural steel and concrete, has opened offices at 141 Milk street, Boston, Mass., but he will retain his main offices and laboratory at Newton Highlands, Mass. Mr. Thompson is well known also for his excellent work in the organization of construction and industrial operations.

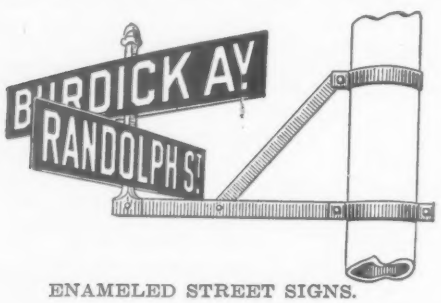
Wynkoop Kiersted has resigned as chief engineer of the Kansas City water works to devote himself entirely to his practice as consulting hydraulic and sanitary engineer, at 640 Midland Building. Mr. Kiersted has had much experience, especially in water supply and power installations, power stations, drainage, and appraisal and adjustment of rates of public utilities.

MACHINERY AND TRADE

Enameled Street Signs

We are illustrating herewith the Burdick vitreous porcelain enamel street sign and post as installed on the downtown streets of Chicago by the Chicago Association of Commerce. These signs were bought by the Chicago Association of Commerce and manufactured by the Burdick Enamel Sign Company, of Chicago.

These street signs measure 24 inches in length and 5 inches in height. The letters are of white on a background of blue enamel and are 4 inches in height. These signs are made of a high grade of English charcoal rolled iron, No. 18, U. S. standard sheet metal gage. Five coats of the best vitreous porcelain enamel is



ENAMELED STREET SIGNS.

fused on the metal with 1,800 degrees Fahrenheit of heat and are guaranteed not to fade or tarnish from the effects of the weather for a period of ten years.

The posts are made with cast iron ring base, 10 inches in diameter at bottom and 30 inches in height, with 7 feet of 2-inch iron pipe welded 1 foot into the casting.

On August 13th, of this year, the city of Chicago advertised for approximately 32,000 of these street signs.

Enamel signs are used for street sign purposes in such cities as Cleveland, O.; Detroit, Mich.; Milwaukee, Wis.; St. Louis, Mo.; St. Joseph, Mo.; Peoria, Ill.; Atchison, Kan.; Butte City, Mont.; Baton Rouge, La.; Cincinnati, O.; Decatur, Ill.; Dallas, Tex.; Evansville, Ind.; Eagle Pass, Tex.; Galesburg, Ill.; Jacksonville, Fla.; Ft. Worth, Tex.; Joplin, Mo.; Jackson, Mich.; Janesville, Wis.; Nashville, Tenn.; Portland, Ore.; Racine, Wis.; Savannah, Ga.; Saginaw, Mich.; Terre Haute, Ind., and hundreds of other smaller towns all over the United States.

Model of Erie Roller

The Erie Machine Shops of Erie, Pa., have adopted an unusual and especially effective means of advertising and calling attention to the details of construction of their steam roller for paving work. The manufacturers are sending out a model of their roller which is made of metal and stands about 3½ inches high. The model makes an attractive desk ornament and serves to illustrate details which could not be explained by literature or descriptive matter. Control levers, steering arrangement, gages, gears and other details are carefully carried out in the small model, and the proportions are practically exact. The model machine has frequently been used as an advertising novelty, but usually it is lacking in detail to such an extent as to make it almost worthless as an accurate miniature of the product itself. The model of the Erie roller is different and will certainly attract the attention of those who may be interested in this class of equipment.

The Erie Machine Shops have been manufacturers of road rollers for nearly a quarter of a century, and their equipment is recognized as one of the highest grades on the market.

The Morse Destructor

The business of designing and constructing furnaces for the disposal of municipal and private waste by incineration, heretofore personally conducted by W. F. Morse, of New York City, has increased in such degree that it has been found necessary to undertake the work on a larger scale, and for this purpose the Atkinson-Morse Destructor Company, with offices at 90 West street, New York City, has been incorporated under the laws of the State of New York.

Beginning in 1889, Mr. Morse has been

engaged in the designing and constructing of garbage disposal plants for public institutions, cities, towns and private establishments. He has made many installations in the United States and foreign countries. Mr. Morse was one of the pioneers in this industry, and built one of the first examples of the British high temperature refuse destructors in this country.

The Atkinson-Morse Destructor Company has acquired the patents owned by Mr. Morse, which cover approved forms of design and construction.

The Morse destructor is built in many sizes to meet the demand for combustion of every class of refuse matter. Some of the points included in this destructor may be noted:

1. A destructor that develops and maintains the high temperature necessary to dissociate and destroy the gaseous compounds thrown off from burning animal and vegetable matter.

2. The construction of the destructor, and the arrangement of the accessories, to conform to the particular conditions of each case.

3. The convenient charging of material, introduction and regulation of air supply, maintenance of uniform temperature and removal of residuals are points of special advantage.

4. In this particular destructor the application of forced draft for obtaining a higher temperature and more rapid combustion has, for the first time in the smaller furnace constructions, been employed with remarkably successful results.

An instructive catalog has been issued by the Atkinson-Morse Company, in which are described the plants at Cambridge, Mass., the U. S. Navy Yard, Boston, the Bush Terminal, Brooklyn, the Hudson Terminals, New York City. The latter installation in the noted Hudson Terminals presents conditions almost identical with those met in the average city of 10,000 inhabitants.

THE MORSE DESTRUCTOR.
A Typical Plant.

Squeegees in Washington, D. C.

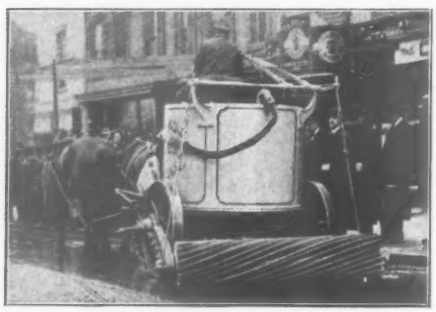
BY ROBERT E. DOYLE, ACTING SUPERINTENDENT OF STREET CLEANING, OF THE ENGINEERING DEPARTMENT, DISTRICT OF COLUMBIA.

On January 24, 1910, the Street Cleaning Department was transferred from the charge of Commissioner John A. Johnston to the charge of Commissioner William V. Judson, and then became a division of the Engineering Department.

The acts of Congress approved March 2, 1911, making appropriation for the expenses of the District of Columbia for the year ending June 30, 1912, authorized the commissioners to perform certain work previously done under contract, namely, street sweeping and cleaning alleys and unimproved streets, and provided $40,000 to be immediately available for the purchase of new equipment to be used in this service, and also provided for the purchase of a site or sites and for the erection of a building or buildings thereon for a stable and storerooms for this division, and appropriated $128,600 to be immediately available for these purposes.

J. W. Paxton, C. E., superintendent of street cleaning, in an official report stated that the Kindling squeegee machines were first placed in regular operation in the hand patrol section of the city, which, in October, 1910, comprised an area of about 1,877,000 square yards. Each gang of squeegees consisted of one sprinkler with three or four squeegees. The sprinkler operated some distance ahead of the squeegees to allow dirt which had become baked and stuck to the pavement to be softened by the absorption of moisture and easily dislodged by the squeegees. Each machine averaged 56,269 square yards per day of 8 hours. On April 26, 1911, the hand patrol area was enlarged to about 2,005,000 square yards, without increasing the hand patrol force, and a gang of one sprinkler and four squeegees operated over this area for 16 hours per day, each squeegee averaging 64,212 square yards per day of 8 hours. By this method the hand patrol area was cleaned by squeegees about one and one-half times per week.

The hand patrol section consists largely of sheet asphalt or asphalt block pavement, smooth enough to allow the operation of the squeegee machines to an advantage. Under the above system of street washing it is found that the streets are almost entirely free from dust. Any dirt which may accumulate does not have time to be pulverized, and the particles are too heavy to be disturbed or blown about by an ordinary wind. Under the old methods of sweeping these heavier and coarser particles were removed, but most of the dust remained, to become a source of annoyance when disturbed by the wind or rapidly passing vehicles, although the streets might have appeared to the eyes to be clean.



THE KINDLING SQUEEGEE MACHINE.

The cost of squeegee operation per thousand square yards for the year ending June 30, 1911, and for the days ensuing between October 14, 1910, and June 30, 1911, was arrived at in the following manner:

SQUEEGEE.

Number of days worked.....	195
Area cleaned, square yards.....50,012,859	
Total cost.....	$5,814.57
Cost per thousand square yards.	$0.1162

FLUSHING.

Number of days worked.....	132
Area cleaned, square yards.....	5,589,367
Total cost.....	$1,765.12
Cost per thousand square yards.	$0.3157

One-Horse Dump Wagons

The illustration herewith shows one of the eighteen one-horse dump wagons owned by the West Chicago Park Commission and used for hauling leaves, shrubbery, waste paper, picnic debris, small tools and other light-weight materials.

"It was formerly our custom," says one of the members of this commission, "to use our regular two-horse dump wagons for light usage. In other words, we were using two heavy park draft horses in work where one horse would be sufficient. We soon decided that this was not good business economy, particularly when there is a rising market for well-bred draft stock, and then again we had enough work in our different departments to keep all our animals busy.

"In light work we find that with these one-yard-capacity dump wagons we can get over the ground quicker, accomplishing a great deal more actual work per day, thus getting more work units per man as well as per horse. The more work we can do for every dollar expended, the better we are satisfied. A certain appropriation is set aside for each division of park work each season, and it is the consequent aim and ideal of every park superintendent and foreman to produce the maximum in real accomplishment. These one-horse dump wagons, of which we now have eighteen, are becoming a great factor in our park development.

"These wagons were made for us by A. Streich & Bro. Co., Oshkosh, Wis."

ONE-HORSE DUMP WAGON, FOR GATHERING LEAVES, AS USED BY THE WEST CHICAGO PARK COMMISSION.

The Meter System

"A large amount of water used and wasted in different cities," states S. Y. High, superintendent Department of Water Works, Kansas City, Mo., "could in a large measure be avoided were the water departments in these cities on a strictly meter basis. A large amount of water is wasted in summer, as well as in winter. I believe all the water above an average of 25 million gallons per day, in Kansas City, is wasted. Were the water department on a strictly meter basis throughout the amount of water wasted would not be so large, although had the same conditions existed and the water wasted, the department would have received the additional revenue. The flat rate, in my opinion, is an incentive to the property owners to put in cheap plumbing, without proper precaution being taken to protect it during cold weather.

"The waste of water is estimated by competent authorities to be 60 per cent. of the pumpage; in other words, but 40 of each 100 gallons of water is actually put to some good use and paid for. Of course, it is possible to control this waste of water, and there are two ways of doing it. The first is by rigid rules absolutely enforced, and thorough, frequent inspection; the other method, the more sensible plan of asking each consumer to pay for the water he uses or wastes.

"There certainly can be no such thing as free water unless perhaps when a man takes his bucket, goes to the source of supply and helps himself, and even then if his time is worth anything the bucket of water has an appreciable cost. There can be no such thing as free water when it is delivered through pipes, as in a city's water works. Some one must pay for the cost of delivering each and every gallon; and if some one has free water, it must follow that some users pay more than they ought, or else the plant will be run at a loss.

"Leading officials emphatically declare that the water meter system must now be considered an essential part of modern water works equipment. To fully appreciate the economy to be secured from the employment of the water meter system, it is necessary to consider the results which it accomplishes, and which can be expressed in a general way by saying: 'The water meter system prevents the many losses which must occur whereby water is sold by any other method than by meter measurement.' The water meter system operates to (1) prevent water waste; (2) provide an adequate supply without requiring additional machinery, pumps, reservoirs, filters, mains, etc., in face of an increasing demand; (3) reduce operating expenses by lessening pumping, filtering, fuel consumption, labor, etc.; (4) detect unsound plumbing and prevent loss by leakage; (5) determine the exact consumption of each consumer; (6) secure payment for all water delivered; (7) prolong the life of the entire water works plant by preventing unnecessary overburden and greater depreciation.

"That the water furnished should be pure goes almost without saying. Water contaminated with sewage is well known to be a source of disease. Where the natural source is not of quality that fits it for domestic purposes, filtration by the slow sand or more rapid chemical process will fit the water for almost any use.

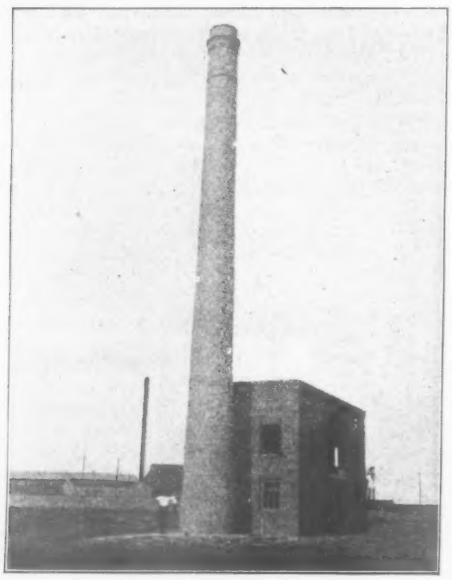
"The water supply of Kansas City, Missouri, is taken from the Missouri river about five miles above Kansas City, at the Quindaro Station in Kansas. The water is pumped directly from the river into settling basins. The water is then treated with lime and sulphate of alumina. After leaving the basins through the back flow or suction pipe, the hypochlorite solution is introduced before the water gets to the pump, the pump agitation making a thorough mixture of the hypochlorite with the water.

"The water is pumped from the river to the first or raw water basin, of fifteen million capacity, where a large part of the heavy material is precipitated before reaching the first weir. At this weir, about six feet wide, the sulphate of alumina is first introduced on the raw water side, and the lime in the second basin, or about ten feet from and after the sulphate of alumina solution. This method precipitates the remainder of the material to be precipitated. After passing over the second weir and entering the third and fourth basins the water is in a first-class condition to be pumped to the city. The 2 per cent. hypochlorite solution is introduced into the suction line to the pump, the pump agitation making a thorough mixture. Kansas City, Missouri to-day has pure and wholesome water."

A DELIVERY OF BADGER WATER METERS TO KANSAS CITY, MISSOURI.

Destructors for Cities or Battleships

The wide range of adaptability and efficiency of the Morse-Boulger destructor is impressively illustrated by the fact that these destructors have been built for a range of capacity from one hundred and thirty tons per twenty-four hours, for use in the city of Manila, P. I., to a capacity of one-half ton per twenty-four hours for use on the U. S. battleship "Minnesota."



DESTRUCTOR BUILT BY MORSE-BOULGER CO., OF NEW YORK CITY.

Not only has this type of plant been adopted by numerous cities and towns that have had difficult garbage and refuse problems to solve, but it has been installed by the U. S. government in about forty different army posts, naval stations and on battleships, after a rigid examination and inspection of many methods of disposal; also by various hospitals, hotels, office buildings, mercantile houses, colleges, etc., in many parts of the country where exact results are necessary.

The designers of this type of destructor have spent many years in the study of efficient and practical incineration methods, the result being that today the Morse-Boulger destructor is an incinerator of patented design containing features of value that highly recommend its use for many varying conditions.

Aside from a few of the features that have been noted, there have been incorporated in this type of plant essentials such as convenience of arrangement for efficient receiving, charging and stoking of refuse, and removal of ashes; the use of forced drafts in large plants, which insures economy and rapidity in operation; highly efficient consumption of gases and smoke; and, in the course of construction, a faithful adherence to the use of materials of high durability and quality.

The manufacturers have installed numerous plants to be operated under special conditions, where the use of gas or oil has been one of the specifications, for the disposal of medical and organic waste in the most complete and sanitary manner.

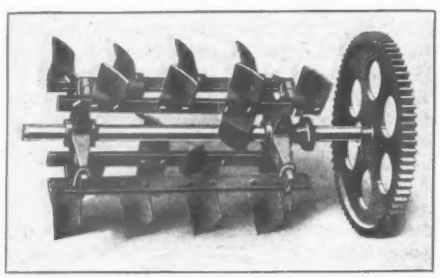
The Hand Batch Mixer

BY C. L. BROWN, MANAGER,
NORTHFIELD IRON CO., NORTHFIELD, MINN.

There is a rapidly developing field for small concrete mixers. I refer not only to small jobs, but to large work, and verify this opinion by the statement that twenty-seven of the largest contracting concerns in Cleveland, Ohio, are using small mixers of our design on all their work.

A small hand mixer can always be loaded into one end of an ordinary farm wagon, and also leave plenty of room for a big tool box. The cost of hauling or transporting it does not amount to that of a contractor's ordinary large tool box. On the job the mixer can easily be shifted about so as to always discharge directly into forms. This saves over one-half the wheeling time. The same staging required for wheeling wet mixture to the forms is sufficient to set up the little mixer on runway, thus saving the wheeling of all wet mixtures.

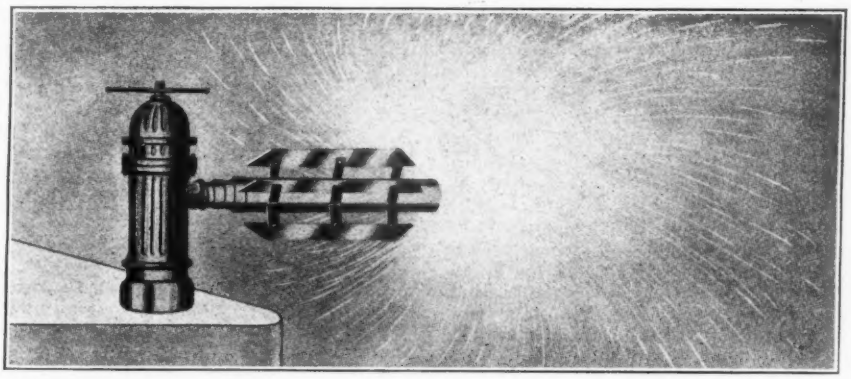
Under favorable conditions it is possible to average nine cubic yards of slush concrete per hour with this mixer, or ninety cubic yards per ten-hour day.



MIXING SHAFT OF NORTHFIELD HAND MIXER, SHOWING MIXING BARS AND BLADES.

There are cases on record where much better speed was obtained. In one case four men charged, mixed and discharged 12 cubic yards per hour and kept it up

for over four hours. This would have equalled 120 cubic yards per day had they kept it up for ten hours. But, of course, such cases as this are not a fair average. From 8 to 9 cubic yards per hour is a fair average under favorable conditions. On foundation jobs and similar work it is easily possible to average from 30 to 60 cubic yards per day, depending on the conditions and how often it is necessary to shift the position of the mixer. On concrete floor work, which is best done by shifting the mixer about every third or fourth batch, so as to discharge the concrete direct into place, about 30 cubic yards per day is a fair average for four men. On a High School job at Cannon Falls, Minn., the contractors, Huschka & Drake, had three men who laid the entire basement floors of that building in two working days, working only 9 hours per day. These floors equalled over 6,500 square feet and contained over 60 cubic yards of concrete. The aggregate had to be wheeled in through doorways, etc., at a great disadvantage, and yet the average was fully 30 cubic yards of concrete per day.



TURBINE SEWER CLEANING MACHINE UNDER PRESSURE. THE SPRAYING AND SCRUBBING ACTION RENDERS SEWERS AS CLEAN AS NEW.

Clogged Sewers a Menace

BY C. E. M'MILLAN, MAYOR, SPARTA, WIS.

That clean sewers are a health safeguard for any community is best attested by a report of an analysis of sewages recently taken in one of our Western cities which has been given wide circulation in the daily press. The bacteria emanating from clogged sewers are equally as detrimental to public health.

I consider clogged sewers as one of the greatest menaces to health in American municipalities.

The city of Sparta was confronted with a serious problem last spring. A number of our sewers had become badly clogged, so that they were causing serious trouble, and our sewer committee was almost convinced that a number of the older sewers would have to be taken up and relaid. However, our attention was called to a number of cleaning machines, and we postponed action until investigation could be made.

The sewer-cleaning machine which we used cleaned two hundred and forty feet of this badly clogged sewer in thirty-five minutes, and we found that our sewers were not only clogged up with roots, but with sand, fecal matter, decomposed organic and vegetable matter and a fungus growth.

Our experience has therefore been that it pays to keep sewers clean rather than tear them up when they become badly clogged. We have experienced no trouble at all in operating our machine, and we are thoroughly convinced that it will save the city thousands of dollars in the future, as nothing seems to stop the progress of the turbine after the water pressure is applied.

I trust our experience will be of some benefit to other cities, as I consider sewer trouble to be as serious a matter as the ordinary city has to contend with.

Perfected Vitrified Sewer Blocks

The American Sewer Pipe Company, of Akron, Ohio, have made a sufficient number of practical tests of their new vitrified sewer block to establish this new type of sewer as a permanent method of construction. The blocks are made in various sizes from 30 to 108 inches, and in three types with various designs of interlocking and sealing devices. The thicknesses of the walls and webs are accurately estimated to meet the heaviest

duty to which the respective sizes can be subjected.

Lewis McNutt, of Brazil, Ind., a well-known manufacturer of clay products, is in position to supply to the trade this new type of sewer block.

Hampton Sedimentation Tank

Mr. Alfred E. Snape, A. M. Inst. C. E., Royal San. Inst., in a recent paper before the Royal Sanitary Institute of Great Britain, enumerated certain basic principles of sewage disposal. These principles, set forth by Mr. Snape, are so carefully maintained in the Hampton sedimentation tank that, preparatory to describing this type of sewage clarifier, Mr. Snape's conclusions have been summarized:

"1. The elimination of the suspended and colloidal solids from the sewage. These are then termed sludge.

"2. The proper and hygienic disposal of the sludge.

"3. The oxidation of the remaining organic matter and ammonia so as to be harmless. And, therefore, the proper function of the tank in sewage disposal works should be the elimination of the suspended solids and the colloidal matters from the liquid. * * * The principle of the sedimentation tank is to obtain all the sludge it can as quickly as it can."

Shortly after the original tank at Hampton, England, was put in operation, an effort was made to operate it without this flow thru the reduction chamber, but the results were unsatisfactory; the deposited solids accumulated on the sloping bottom of the sedimentation chamber and at the slots, and had to be pushed thru the slots into the reduction chamber, while the effluent showed a decided increase in suspended solids. A similar trial has been recently made with the large Hampton tanks at Norwich, England, and has shown equally unsatisfactory results.

There is such a wide variation in both the volume and composition of sewage, not only as between that of different localities, but even from hour to hour, that it is practically impossible to pre-determine the exact proportion of flow thru the reduction chamber required to produce the best results. For this reason the outlet from the reduction chamber is provided with means for regulating this flow. It is to be expected that the reduction chamber effluent will carry some finely divided suspended matter, and it is therefore passed thru small up-flow filters of the Scott-Moncrief type before being added to the effluent from the sedimentation chambers.

The American rights for this type of tank are held exclusively by the Sterilization Co., Newark, N. J.

The Collection of Refuse.

BY E. W. STRIBBLING, SUPERINTENDENT DEPARTMENT OF PUBLIC SERVICE, COLUMBUS, OHIO.

Garbage, rubbish and manure are collected and disposed of by the Department of Public Service according to up-to-date business methods. Accurate and minute records are kept concerning each division of collection. We know the daily cost of horse maintenance as well as the total cost of collection per load and per yard.

An accurate record is kept of the performance and cost of each horse; each horse has a page in the ledger, which is designated by the mark appearing on the hoof of the horse. His cost, maintenance and earnings can be ascertained at a glance. His costs are debited and the worth of his work is credited to him.

In our tables we maintain a daily average of 115 head of horses, 14 barn helpers and a night watchman. The daily average cost of hay, straw, corn and oats is $52.36, and the labor will average $30. Consequently the average daily feed cost per horse amounts to 72 cents.

Prior to May, 1911, the only refuse which we collected was pure garbage, but since that date this department has attended to the removal of all garbage, rubbish and manure.

Our buildings consist of a loading station and stable. The loading station is a suitably constructed two-story brick building, with railway tracks extending thru its entire length. The dump wagons empty their contents from the second floor into the cars on the first floor.

As regards the collection of pure garbage: We have subdivided the city into thirty-one districts, which are so grouped as to give each team an equal number of miles per day. We use the "long and short haul" method. By this method no team travels more than sixteen miles per day, while the average daily saving in travel per team is about 1½ miles per day. Each team collects two loads daily, except that those collecting from hotels collect three. The loads must average 1½ tons.

All rubbish is disposed of by hauling to dumps. For this department of collection we have subdivided the city into eight districts, each being in charge of a foreman who has under his control about four teams, four drivers and one helper. There are about thirty-two teams employed regularly. To collect once in two weeks would require about forty teams the year round.

The amount and cost of dry refuse and manure collected for the months of January, February, March, April and May of 1912 are as follows:

DRY REFUSE AND MANURE COLLECTED IN 1912.

Month.	Dry Refuse Loads.	Yds.	Labor and Teams.	Other Labors.	Manure Loads.	Yds.	Tons.	Labor and Teams.
January	1,735	5,205	$3,095.00	$275.32	463	2,315	926	$1,053.00
February	2,186	6,558	3,352.25	272.50	433	2,165	866	1.061.50
March	1,973	5,919	3,036.75	272.50	374	1,870	748	924.35
April	3,967	11,901	5,482.97	272.50	192	960	384	360.80
May	2,950	8,850	4,292.50	272.50	234	1,170	468	591.00
Total	12,811	38,433	$19,259.47	$1,365.32	1,696	8,480	3,392	$3,990.65

Dry Refuse.

Cost of teams and labor	$19,259.47
Superintendence, inspection, etc.	1,365.32
Supplies, repairs, etc.	270.00
Total	$20,894.79
Cost of Collection per load	1.64
Cost of collection per yard	.54

Manure.

Cost of teams and labor	$3,990.65
Superintendence, inspection, etc.	482.00
Supplies, repairs, etc.	135.00
Total cost	$4,607.65
Received from the sale of manure*	2,216.75
Actual cost	$2,390.90
Cost of collection per load	2.72
Cost of collection per load, receipts deducted	1.41
Cost of collection per yard	.55
Cost of collection per yard, receipts deducted	.28

*Price received, 50 cents per ton f. o. b. city tracks, or $1.25 to $1.50 per wagon load, depending on length of haul.

BAIN TYPE OF DUMP WAGON USED BY CITY OF COLUMBUS.

The dump wagons used for the collecting of dry refuse and manure are of the Bain type. Having but one lever for closing the doors and dumping the load, the driver need only lift the dog and push the lever forward. Because of the large drum on which the chain is wound it is necessary to move the lever forward and back only a few times. Only one chain is used. The doors are hung by heavy loops instead of rigid hinges. This allows them to be raised about 8 inches and prevents them from being torn off when moving forward after dumping. The doors close almost water-tight. The steel axles are reinforced by heavy hickory bed pieces, securely clipped on, which strengthens the axles and prevents springing or breaking.

The amount and cost of equipment maintained by this department is:

Loading station site	$10,136.40
Loading station	14,101.64
Collection stables	42,260.81
Trestle and driveway	2,153.10
Grading, fill, electric wiring	2,379.54
Railway siding	3,161.60
Garbage cars	7,564.00
Garbage wagons	7,151.10
Manure wagons	1,238.93
Dump wagons	3,466.50
Dead horse wagons	300.00
Small animal wagons	185.00
Coal wagons	625.00
Tree wagons	90.00
Buggies	305.00
Horses	24,000.00
Harness and stable supplies	5,484.31
Office equipment	522.51
Steel lockers	310.00
Total	$125,435.44

Harder Motor Driven Combination Chemical and Hose Wagon

The city of Chicago has recently installed a combination chemical and hose wagon built of special design in such manner as to withstand the severe strains which it is necessary for fire fighting apparatus to undergo. The highest grade of material was used throughout. The construction in every wearing part and every point of stress was thoroughly reinforced or braced.

The dissatisfaction which has been caused by so many pieces of cheap or poorly constructed apparatus has led city officials generally to a realization of the fact that fire fighting apparatus cannot be too strongly built if it is to render efficiency in the service required of it. City officials have begun to realize that an inefficient piece of apparatus, liable to break-downs of any sort, is not only expensive but positively dangerous. Fire fighting apparatus must be dependable.

City officials will, therefore, be interested in the specifications under which this new combination wagon was built. Copies of the complete specifications can be obtained from the manufacturers, the Harder Auto Truck Company, 162 W. 62d street, Chicago, Ill.

Nashville Man Describes Good Roads Covered on Auto Trip

One of the most enthusiastic boosters for Nashville, Tenn., is W. E. Jordan. On July 12 Mr. Jordan, accompanied by members of his family, left Nashville on a pleasure trip that, for distance and the number of points made, breaks the local record. In talking to representatives of the Good Roads Department of the Board of Trade, upon his return, Mr. Jordan gave this account of his trip:

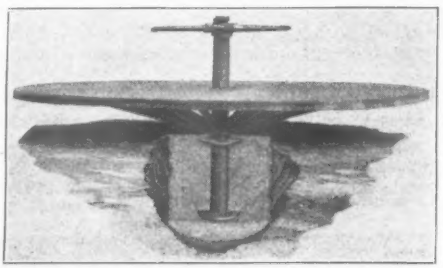
"Our party left Nashville on the morning of July 12, and made a number of cities, stopping at each place long enough to see the points of interest and to pay a visit to friends. In many respects," said Mr. Jordan, "this was a very remarkable trip. One of the things to be mentioned is that we traveled a distance of 3,857 miles.

"The best roads on the trip were found in New York and Pennsylvania, and I would like to state just here that too much praise cannot be said for the Warrenite roads in Allegheny county, Pennsylvania, of which Pittsburg is the county seat. In passing through this county it was a pleasure to notice how well these roads were built. At one point I coasted my car for a distance of 5⅛ miles, which in itself was a remarkable feat."

The National Rol-A-Gig.

The National Amusement Construction Co., Toledo, O., is manufacturing an extremely popular amusement device for use in parks and playgrounds. It is a play machine which is not monopolized by a few children, but easily affords fun for as many as 100 at a time.

The construction of the Rol-A-Gig is most substantial. The platform or tableland is 16 feet in diameter, made of the best seasoned siding firmly held with 2x4 girders securely bolted and sectional. The base of the machine is set in concrete or solid earth to a depth of five feet. It is fitted with ¾-inch ball bearings



THE NATIONAL "ROL-A-GIG."
Showing Details of Construction.

in the best of tubular iron and steel and is built to accomodate as many as the Rol-A-Gig will comfortably contain.

There are no cog wheels or other dangers to encounter. The speed is at all times under control and can be regulated to please the most exciting turn of any child.

The Tractor Service in New York.

The city of New York is employing a number of Martin tractors in combination with heavy trucks, such as is shown in the accompanying photograph, to handle garbage on long hauls. The trucks are drawn from house to house by horses until the collection is finished. They are then jacked up at stations provided for the purpose and the tractor is coupled on for the long haul to the dump. It was found that the horses were more efficient where frequent stops are necessary, but on the long hauls the tractor is much quicker and can haul a much greater distance.

One tractor handles six wagons over an average haul of from 4 to 6 miles. Two and one-half miles is the shortest distance covered. The wagons are in each case covered and water tight. A ring is provided at the front of the truck, so that upon arriving at the dump, a crane lifts the truck complete and swings it suspend-

ed from its forward end until it is over the garbage barges. A trip is then thrown and the garbage is dumped thru the back end of the wagon bed.

The Martin tractor used may be briefly described as a motor mounted on a frame, supported from the front by a single wheel, by which it is steered, and at the rear by two wheels which form the front wheels of a four wheeled heavy vehicle. The combination makes a five wheeled motor-drawn truck, where the power is applied in pulling instead of in pushing the load.

The tractor has proven out in practice. It has drawn nine tons 20 miles in an hour, climbed a 14 per cent grade at 8 miles an hour, worked perfectly on slippery pavement and in sand and mud. It has turned a piece of apparatus 57 feet long over all completely around in a 30-foot street. It has drawn a 5,500-pound ladder truck 2,500 miles at an average speed of 20 miles per hour—(making as high as 30 miles per hour on good roads) without developing a weakness in either ladder or tractor. The ladder truck is iron-tired and is fifty years old. This test was made to prove that the iron-tired vehicle would stand the strain of high speed. It has climbed a wet cobblestone paved hill with a 12 per cent grade, drawing behind it a loaded motor truck. The total load in this test was 18,000 pounds and only 21 per cent was on the steel-tired traction wheels.

New Filtration Plant for St. Louis Water Works

St. Louis is to have a new $12,000,000 city water filtration plant to take the place of a coagulant plant now in use at Chain of Rocks, the home of the present city water-works, three miles north of the business district, and located on the Mississippi river.

Recommendations of Water Commissioner Edward H. Wall, made in a report recently submitted, were favorably received by Mayor Frederick H. Kreismann, and by members of both branches of the municipal assembly. A bill has been introduced in the lower branch of the assembly providing for an appropriation, and it is thought it will be passed.

In his report Commissioner Wall predicted a severe water famine within five years' time, unless the present intake system were extended.

The capacity of the new water-works is to be 150,000,000 gallons, an increase of 25,000 gallons over the present limit. The coagulant plant now in use can accommodate only 100,000,000 gallons, and it is proposed to enlarge this to meet all demands until 1935.

There are 107,500 service connections with city water mains, and the average daily consumption for the last fiscal year was 83,600,000 gallons. The highest for one day was 112,000,000 gallons.

Considering the natural increase in population and the consequent demand upon the water department, Water Commissioner Wall estimates 1923 will see St. Louis with a population of 843,000 and the demand for water will be 113,000,000 gallons as a daily average.

The new intake plant may be located on the Missouri river, in St. Louis county, near where that tributary meets the Father of Waters.

It is planned to have water meters installed generally not later than 1918, in order to reduce the consumption of water, figures of which are said by water experts to be illustrative of excessive use.

Calendar of Technical Meetings

American Road Builders' Association, Cincinnati, Dec. 3-6. Secretary, E. L. Powers, 150 Nassau Street.

American Institute of Chemical Engineers, Detroit, Mich., Dec. 4-6. Secretary, J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

National Society for the Promotion of Industrial Education, Philadelphia, Dec. 5-7. C. A. Prosser, Secretary, 105 East Twenty-second street, New York City.

Engineering Association of the South, Nashville, Tenn., Dec. 6-7. W. Harwell Allen, 930 Stahlman Bldg., Nashville, Tenn.

Association of American Portland Cement Manufacturers, New York, Dec. 9-12. Percy H. Wilson, Secretary, Land Title Bldg., Philadelphia, Pa.

Indiana Good Roads Association, Better Roads Convention, Indianapolis, Dec. 10-12. C. A. Kenyon, President, Indianapolis.

National Association of Cement Users, Pittsburg, Pa., Dec. 10-13. R. L. Humphrey, President, Harrison Bldg., Philadelphia, Pa.

American Society of Engineering Contractors, Dec. 12. Paper by Geo. C. Warren, "Development of the Modern Country Roadway." J. R. Wemlinger, Secretary, 21 Park Row, New York.

Municipal Engineers of the City of New York. Annual dinner, at Hotel Savoy, Jan. 11, 1913, 7 p. m. Geo. A. Taber, Secretary, 29 West Thirty-ninth street.

Trade Notes

The Knox Automobile Company, of Springfield, Mass., have contracted with the Canadian General Electric Company to handle their entire commercial and fire vehicle line throughout Canada.

A recent announcement by the Atlas Portland Cement Company, 30 Broad street, New York City, calls attention to the fact that 5,000,000 barrels of Atlas Portland cement have been supplied for the construction of the Panama canal, without the rejection of a single barrel. The United States government has placed orders for a sufficient additional supply to complete the work in the entire canal zone.

Queen-Gray Company, Philadelphia, Pa., a new company, has purchased the business of Queen & Co., well-known manufacturers of engineering, electrical and scientific instruments.

IMPROVEMENT AND CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Fernandino, Fla.—Dec. 18, 1912, until 3 p. m., for doing the work and furnishing the material required for laying approximately 11,000 square yards of vitrified brick pavement on Center street, between Fifth and Eleventh streets. G. L. Baltzell, city clerk.

Rome, Ga.—Dec. 9, 1912, for the paving of Fourth avenue, East Fourth street and Avenue A. Estimated cost, $40,000.

Rome, Ga.—Dec. 9, 1912, until noon, for grading, curbing and paving with either wood block, vitrified brick, Hassam compressed concrete, asphaltic concrete, sheet asphalt or bitulithic material. The work will embrace approximately furnishing and setting 8,900 lineal feet of granite curb, or concrete curb and gutter, foundations and surfacing 19,000 square yards pavement. W. M. Wilson, city engineer.

Pikeville, Ky.—Dec. 9, 6 p. m. For the construction of about 25,000 square yards of street paving with vitrified brick on a 6-inch concrete base, including combined curb and gutter. P. J. Preston, mayor; Amick & Haynes, engineers.

Columbus, O.—Dec. 10, 1912, until 11 a. m., for grading and paving with brick for heavy traffic, the No. 3 Improvement Richmond road. State Highway "D" Pet. No. 374, in Euclid township, Cuyahoga county. Estimated cost of construction, $31,442.50. Length, 5,544 feet or 1.32 mile. Width of pavement, 14 feet. Draft or certified check, $1,000. The successful bidder will be required to give bond equal to the contract price. Date set for completion, Aug. 1, 1913. James R. Marker, state highway commissioner.

Ambridge, Pa.—Dec. 29, 1912, until 7 p. m., for furnishing material and constructing a concrete wall along First street. Certified check, $50. M. H. Allen, secretary Ambridge council.

CONTRACTS AWARDED.

Corona, Cal.—The contract to improve Grand boulevard was awarded to O. F. Easley, of Alhambra, for $50,000, by the city council.

Los Angeles, Cal.—The Barber Asphalt Company was awarded the contract for the asphalt paving of Alameda street, between Seventh and Twenty-first streets. Price, $71,635.63.

Sacramento, Cal.—The following road contracts have been awarded: Constructing a macadam road in Santa Clara county, to the City Street & Improvement Co., $41,905; constructing an oiled concrete road in Sonoma county, to Richard Keating & Sons, San Francisco, Cal., $61,396; constructing an oiled road in Los Angeles county, to Rogers Bros., Los Angeles, Cal., $33,043; constructing an oiled concrete road in Santa Clara county, to A. Teichert & Son, Sacramento, Cal., $30,688.

Huntington, Ind.—On a bid of $11,990, contract for the Young road in Polk township, was let to Jackson & Gordon, of Wells county.

Marion, Ind.—Contracts have been awarded as follows: The P. A. Daley gravel road, on the Mill-Monroe line, to Matthews Nelson, at a contract price of $8,873; the Daniel W. Rouse stone road with Tarvia binder in Mill township, to the Garver Construction and Transfer Co., of Hamilton, O., for $21,542.50; the Alvin J. Thomas road in Mill township, for $24,848.50; the Don Daily road in Mill township, at the contract price of $10,649, to Drock & Co.

Iowa Falls, Ia.—The $91,353.86 contract for paving streets in this city was awarded to Wm. Horrabin, of Iowa Falls.

Hamilton, O.—Joseph Garver was successful in landing a $50,000 contract for the macadamizing of a road near Marion, Ind.

Salem, O.—Joseph T. Smith has been given the contract for paving with brick one mile of the Ellsworth road. Price, $15,825.

Tulsa, Okla.—A $120,000 street paving contract was awarded on the majority of the streets to the Eureka Construction Co., and on the balance to the E. P. McCormick Co.

Portland, Ore.—The contract for paving the approaches of the Broadway bridge has been awarded to Giebish and Joplin. Price, $13,589.

Philadelphia, Pa.—Gibbs & Co. have been awarded contracts for the construction of the following roads: Blackwood turnpike, from City line to Bellmawr, on a concrete base with "Amiesite" top, $72,569.62; Cuthbert road, from the Haddonfield turnpike to the White Horse road, with "Amiesite," $19,890.15; Blackwood to Clemonton, $59,638.80. On the Clementon end of the road, 4,000 feet is to be "Amiesite," and on the Blackwood end, 4,500 feet is to be "Amiesite," and between these points the construction will be of macadam.

Dallas, Tex.—The contract for paving of Pennsylvania avenue, from Colonial to Oakland avenue, has been awarded to the Texas Bitulithic Co.

Fort Worth, Tex.—The General Construction Company has been given the contract for the pavement of Bessie street, between Cromwell street and the International tracks.

Sherman, Tex.—The Parker-Washington Co., of Kansas City, Mo., has been awarded the contract for the brick paving in the business section. The Creosoted Wood Block Paving Co., of New Orleans, was given that of the wood block.

Walla Walla, Wash.—L. Lanning, at his bid of $38,900, secured the contract for five miles of road to connect the state line with state aid road No. 99.

CONTEMPLATED WORK.

Chicago, Ill.—The construction of sidewalks (cement) in North Hamlin avenue, Wentworth avenue, South State street, West Sixty-third place, West Twenty-second street, South Fifty-second avenue, Gladys avenue, Greenwood avenue, Canal Port avenue, Dem-

ing place, and cinder sidewalks in Addison street, West Ninety-fourth street and Bishop street, has been ordered. Board of local improvements.

St. Paul, Minn.—The city is contemplating the paving of the following streets: Kent street, from University avenue to Minneapolis street, at an estimated cost of $11,563 for macadam, to $35,004 for granite; Jackson, from Seventh to Ninth, at a cost ranging from $2,257 to $4,910; Arundel street, from Marshall avenue to Rondo street, at an estimated cost of from $6,502 to $12,569; Dayton avenue, from Victoria street to Chatsworth, at an estimated cost ranging from $6,510 to $15,006.

Nevada, Mo.—An election here resulted in favor of issuing road construction bonds to the amount of $20,000.

St. Joseph, Mo.—Rackliffe & Gibson Construction Co. were awarded the contract for resurfacing the brick pavement on King avenue, from Sixth street viaduct to Missouri avenue, with asphalt. The bid was $1.44 per square yard, and the aggregate cost will be about $27,000.

Rochester, N. Y.—A $50,000 bond issue for good roads was carried by a vote of 10,629.

Canton, O.—The repaving of West Tuscarawas street, from the Square to Harrison avenue, is contemplated, at an estimated cost of $80,737.75.

Cincinnati, O.—A $60,000 bond issue for the improvement of many streets and sewers has been authorized by the city council.

Dayton, O.—The improvement of Brightwood avenue, by grading and graveling the roadway, setting combined curb and gutters of cement with boulder border and paving the streets and sidewalks with cement, is contemplated. Wm. D. Huber, president of council.

Dayton, O.—The improvement of Creighton avenue, from Wyoming street to Getch street, by grading and graveling the roadway, setting combined curb and gutters of cement with boulder borders 2 feet wide and paving the sidewalks is contemplated. Wm. D. Huber, president of council.

Dayton, O.—The improvement of Whitmore avenue, from National to Kennard avenue, by grading and graveling the roadway, setting combined curb and gutter of cement with boulder border 2 feet wide and paving the sidewalks with cement is contemplated. Wm. D. Huber.

Lancaster, O.—A resolution ordering sidewalks, curbs and gutters on both sides of Sixth street, from Broad street to Garfield avenue, has been passed.

Massillon, O.—Contracts will be advertised for early next year for the improvement of about four miles of Wooster road between the end of the present paving in West Brookfield through East Greenville to the Wayne county line. Stark county commissioners.

Youngstown, O.—An ordinance determining to proceed with the improvement of Pine street, between Woodlawn avenue and Fairmount avenue, from Haesley street to South avenue, by paving the same, has been passed.

Zanesville, O.—Grading and paving of Wheeling avenue, from Greenwood avenue to the corporation line, with vitrified brick and the construction of concrete curb has been authorized. John H. Schofield, mayor.

Pittsburg, Pa.—An ordinance has been passed authorizing the grading and paving and curbing of Sixth avenue, from Beach avenue north to the northern boundary line of Palmer avenue.

Rochester, Pa.—An ordinance providing for the subgrading and paving of Deer lane, between Connecticut avenue and Virginia avenue, has been passed.

Tarentum, Pa.—An ordinance authorizing the grading, paving and curbing of East Ninth avenue, between the west line of Wood street and the east line of Ross street, has been passed. Borough engineer.

Seattle, Wash.—The board of public works will advertise for alternate bids for brick or bitulithic paving on West Fremont avenue.

Moundsville, W. Va.—An election here resulted in favor of issuing road improvement bonds to the amount of $150,000.

Burnaby, B. C.—The election here resulted in favor of issuing the following bonds: Road improvement, $25,000, and street improvement, $50,000.

SEWERS.

BIDS REQUESTED.

Tipton, Ia.—Jan. 15. Construction of sewers. P. D. Ketelsen, city clerk.

New Orleans, La.—Dec. 20, 12 m. Furnishing and erecting a mechanical draft apparatus. F. S. Shields, secretary, sewerage and water board; Geo. G. Earl, general superintendent.

Fort Stevens, Ore.—Dec. 10, 1912, until 11 a. m., for the construction of approximately 2,400 feet of 4-inch pipe line at Fort Canby, Wash. Augustus Norton, first lieutenant, C. A. C. Q. M.

CONTRACTS AWARDED.

Washington, D. C.—The contract for the construction of water works and sewerage system in Bridgewater, Va., has been awarded to the Newport News Construction Co., Newport News, Va. Price, $22,704.

Nashville, Ga.—The contract for the construction of a sewer system has been awarded to the J. B. McCrary Co., Atlanta, Ga. Price, $10,500. The system comprises about three miles of sewers.

Kankakee, Ill.—The National Drain Tile Co., of Terre Haute, Ind., was awarded the contract for eighteen miles of sewer. Price, $60,000. The contract requires 200 car loads of tile.

Quincy, Ill.—The contract for the South Side sewer has been awarded to Henry Rees. Price, $77,000.

Summit, Ill.—The Nash-Dowdle Co., 95 La Salle street, Chicago, Ill., has been awarded a contract for construction of sewers.

Kokomo, Ind.—The construction contract for the Pete's Run sewer has been awarded to Michaels and Minnich Construction Co., for about $27,000.

Grand Rapids, Mich.—The contract for the construction of the Wealthy sewer extension has been awarded to Joseph Rushe. Price, $27,013.

Kansas City, Mo.—Contract for a district sewer was awarded to A. D. Ludlow. Price, $32,366. The sewer is to be constructed of vitrified clay pipe.

Libby, Mont.—The contract for several sewers was awarded to Rose & Reynaud. Price, $14,520.

Lorain, O.—The contract for the construction of a sewer in Broadway has been awarded to G. F. Randall, of Lorain. Price, $12,313.

Waco, Texas.—Newman B. Gregory, of Greenville, has been awarded the contract for the construction of a storm sewer on Mary street, from Eleventh street to Brazos river. Price, $42,327.70.

CONTEMPLATED WORK.

Taft, Cal.—A $25,000 bond issue for a sewer system has been voted.

Gastonia, N. C.—A $12,500 bond issue for sewer improvement has been voted.

Canton, O.—Engineer L. E. Chapin has submitted plans for two sewage disposal plants on the Howerstine site at an estimated

cost of $477,500 and $342,000, respectively. Service Director Harbert.

Cleveland, O.—An ordinance providing for a $2,000,000 bond issue for a sewage disposal plant or plants has been voted.

Columbus, O.—Ames Brothers were given the contract for the construction of the Glenwood Heights sewer, on their bid of $22,-081.98.

Mansfield, O.—An ordinance has been passed to construct an 8-inch sewer in Reba avenue, from Marquis street to Main street, with all necessary manholes and flush tanks. G. H. Lowery, president of council.

Mansfield, O.—Construction of sewers on both sides of Purdy street, on East street, Blecker street, Wayne street and on both sides of Perry street, together will necessary manholes and flush tanks has been authorized. G. H. Lowery, president of council.

New Philadelphia, O.—Construction of a trunk sewer from Tuscarawas river to the old storm sewer at B. & O. R. R. crossing, near the ice plant on West High street, Ray street, with necessary appurtenances has been authorized. G. M. Earle, president of council.

Youngstown, O.—Ordinances providing for the following sewers have been passed: Construction of a sewer in Morgan street, between Hillman street and the present end of sewer in Kendall avenue; also constructing a district sewer between the northerly city limits and the Mahoning river. Sol. S. Davis, president of council.

Sulphur, Okla.—A $17,500 bond issue for sewer construction has been voted.

Clearfield, Pa.—Construction of an 8-inch sewer on West Fifth avenue with necessary manholes, etc., is contemplated. C. E. Roseberg, president of council.

Canonsburg, Pa.—Construction of an 8-inch sanitary sewer with 4-inch lateral connection on South Jefferson avenue has been provided for. A. Sheldon, chairman of council.

Jessup, Pa.—C. E. Beland has been awarded the contract for the construction of a storm sewer basin. His bid was $11,002.

S. Bethlehem, Pa.—A $130,000 increase in the indebtedness of the borough to build a sewage disposal plant has been voted.

WATER WORKS.

BIDS REQUESTED.

Sioux City, Ia.—Dec. 14, 1912, for the construction of a reinforced concrete reservoir, 143 feet inside diameter, 33-foot high walls, average 17 inches, also reinforced concrete addition to present reservoir. D. H. Maury, 1125 Monadnock building, Chicago, Ill., has plans and specifications. G. B. Healy, city clerk.

Yankton, S. D.—Dec. 16, 1912, for the furnishing of all tools, labor, material and equipment for the construction of and finishing complete, ready for operation, the new water works. John W. Summers, city auditor.

CONTRACTS AWARDED.

Stockton, Cal.—The Pacific Gas and Electric Co. was awarded a franchise for extending water mains into the McCloud addition.

Appleton, Wis.—The contract for a filtration plant has been awarded to the Jewell Water Improvement Co., of Chicago, $49,869.

Waco, Texas.—The Pittsburg Filter Co. awarded the contract for installing a water filtration plant. Proce, $85,000.

Reading, Pa.—H. L. Campbell, of Hazelton, has been awarded the contract for the repair of the reservoir of Shenandoah.

Huntington, W. Va.—John R. Day was awarded the contract for extending the water service in Colis avenue, from Twenty-sixth to Twenty-eighth street.

Grand Rapids, Mich.—Verhey & Kloote were awarded the contract for laying of the water main in Tamarack and Eleventh streets.

Summit, Ill.—W. T. Ryan, Lyons, Ill., has been awarded the contract for extending the water works system of Summit, Ill. This work includes the laying of 2,786 lineal feet of 6-inch cast iron pipe, erection of six double nozzle fire hydrants and six 6-inch double gates.

Dayton, O.—At a bid of $14,200 the Chicago Bridge and Iron Works was awarded the contract for installing the steel tank and tower which will furnish an auxiliary supply of water to Dayton View and Riverdale next year.

CONTEMPLATED WORK.

Los Banos, Cal.—A $27,000 bond issue for a water plant has been voted.

La Grange, Ga.—A $150,000 bond issue for water works has been voted.

Kamiah, Ida.—The election here resulted in favor of issuing water works bonds to the amount of $12,500. J. B. Hurle, village clerk.

Chicago, Ill.—The construction of water service pipe lines in Wallace street, North Ridgeway avenue, Hutchinson street, North Forty-sixth street, North Sawyer avenue, Lowerill avenue, Galt avenue, North Forty-seventh avenue, Syracuse avenue, North Springfield avenue, Pensacola avenue, North Lawnsdale avenue, South May street has been authorized. Board of local improvements.

Bedford, Ind.—Water works improvement bonds of this city to the amount of $25,000 have beep voted.

Logansport, Ind.—A $60,000 appropriation for a filtration plant carried in this city.

Ramsey, N. J.—A $65,000 bond issue for water works has been voted.

Nyack, N. Y.—Village Clerk Henry E. Smith informs us that the amount of reservoir and water works bonds voted Nov. 7 was $25,000.

Cincinnati, O.—The Eden Park reservoir will be relined with Portland cement and waterproofing at an approximate cost of $15,000.

Geneva, O.—The election here resulted in favor of issuing water works improvement bonds to the amount of $10,000. W. E. Morgan, village clerk.

Lima, O.—A $100,000 bond issue for water works improvement has been voted.

Lorain, O.—The city will readvertise for bids for furnishing 500 or more water meters to be used by the water works department.

Pleasant City, O.—A $15,000 bond issue for water works system construction has been voted.

Pittsburg, Pa.—The election resulted in favor of issuing water extension bonds to the amount of $1,620,000.

Bowdle, S. D.—Engineers Wells and Easton, of Aberdeen, have completed plans for a water works and electric light plant. Estimated cost, $22,500.

Dallas, Texas.—The construction of a filtration plant has been awarded to the American Water Softener Co. Price, $200,000.

BRIDGES.

BIDS REQUESTED.

Steubenville, O.—Dec. 10, 1912, for the necessary labor and the material for the construction of the sub-structure of Bridge No. 15 in Knox township, over Croxton's run. Sherman M. Floyd, clerk of the board.

CONTRACTS AWARDED.

Marysville, Cal.—The Portland Concrete Pile Co. has been awarded the contract for the construction of the bridges in Yuba county. Price, $12,750.

Napa, Cal.—The contract for the construction of the new stone bridge across Trancas creek, north of Napa, was let to H. W. Wing, on his bid of $15,972.

Denver, Colo.—The contract for the construction of the Downing street bridge over Cherry creek has been awarded to the C. P. Allen General Contracting Company, 312 McPhee building. The company's bid of $13,091.50 was the lowest of the six submitted.

Tampa, Fla.—The Edwards Construction Co. has been awarded a contract for the construction of a temporary bridge over the river from Jackson street on the east side to Eagle street on the west side. Price, $5,800.

Augusta, Ga.—Contract for the construction of the Archibald Butt Memorial bridge has been awarded to the Concrete Engineering and Construction Co., of Birmingham, Ala., at $20,852.

Chicago, Ill.—The lowest bid submitted for constructing the sub-structure of a double leaf bascule bridge over the Chicago river at Chicago avenue was that of Byrne Bros. Dredging and Engineering Co., 72 West Adams street, for superstructure complete, including machinery, electrical equipment, steel work, concrete work, iron ornamentation, light appliances, floors, railings, etc., $105,346.

Springfield, Ill.—Frank R. Miller, of Springfield, was granted a contract for building a bridge at Salisbury. His bid for erecting the 200-foot steel span across the Sangamon river was $12,000.

Watseka, Ill.—W. H. Shons, of Freeport, Ill., has been awarded the contract for the construction of a town line bridge in Ashgrove township, Iroquois county, at $4,600.

North Auburn, N. Y.—The Groton Bridge Co., North Auburn, N. Y., has been awarded a contract at $9,649 for the construction of a new steel bridge encased in concrete, over the Owasco river.

Cleveland, O.—The contract for all secondary piers for the new high level bridge has been awarded to the Great Lake Dredge & Dock Co. Price, $497,000.

Lisbon, O.—Contracts for the construction of five bridges in Washington township have been awarded to the Canton Concrete Construction Co., of Canton, O., at an aggregate cost of $25,000.

Fort Worth, Texas.—The contract for the construction of Main street concrete viaduct was awarded to Hannon Hickey Bros. Construction Co. Price, $373,948. Contract for the Seventh street bridge was awarded to Tarrent Construction Co., $106,773.

CONTEMPLATED WORK.

Des Moines, Ia.—The election here resulted in favor of issuing bridge bonds to the amount of $100,000.

Columbus, O.—The following bond issues have been voted: $80,000 to build a bridge over the creek in Alger road, and $30,000 to build one in Schrock road, near Westerville.

Findlay, O.—An election here resulted in favor of issuing bridge bonds to the amount of $25,000.

GARBAGE DISPOSAL.

CONTRACTS AWARDED.

San Diego, Cal.—J. W. Walton has been given the contract for erecting a 6-unit McGuinn incinerator at a cost of $16,000.

Sharon, Pa.—The contract for the construction of a garbage disposal plant has been let to J. P. Simon. Price, $6,508.

LIGHTING, STREET AND OTHER.

CONTEMPLATED WORK.

Tipton, Ind.—The installation of enough cluster lights to illuminate the business portion of the city to replace the electric arches over the streets is contemplated by Mayor Compton and the Business Mens' Club.

Corydon, Ky.—The bond proposition of $8,000 for electric lights for Corydon, this county, carried.

Corydon, Ky.—The election here resulted in favor of issuing electric light bonds to the amount of $10,000.

Owatonna, Minn.—The election here resulted in favor of issuing electric light bonds to the amount of $10,000. C. J. Servatius, city clerk.

Alliance, O.—A $15,000 bond issue for the erection of a municipal lighting plant has been voted. L. L. Lower, councilman.

Columbus, O.—Cluster lights to cost approximately $83,000 are to be installed in the streets. H. E. Eickhorn, superintendent municipal light plant.

BUILDINGS.

BIDS REQUESTED.

Cleveland, O.—Dec. 16, 1912, for the structural steel work for the new municipal electric light plant. F. W. Ballard, superintendent.

Defiance, O.—Bids will be received until Dec. 14, for the construction of a new postoffice, to be completed June 1, 1914. Plans and specifications are now on file with C. J. Thompson, postmaster.

CONTRACTS AWARDED.

Menominee, Ill.—Contract for the construction of a new court house has been awarded to the Herman Construction Co., of Antigo, Wis., at their bid of $14,000.

Monticello, Miss.—The Little-Cleckler Construction Co., of Anniston, Ala., has been awarded the contract to build a $45,000 court house.

Wilkinsburg, Pa.—Grant McCargo has been awarded the contract for building a new four-story fireproof steel and concrete postal station for this city.

Cleburne, Texas.—The contract for the construction of a new court house has been awarded to the American Construction Co., of Houston, Texas. Price, $200,000.

CONTEMPLATED WORK.

Chicago, Ill.—The election here resulted in favor of issuing the following bonds: County home, $1,000,000; hospital, $500,000.

Des Moines, Ia.—The election here resulted in favor of issuing a juvenile home bond in the amount of $12,000.

Oskaloosa, Ia.—The proposition to build a new $135,000 court house in Calhoun county was carried.

Murray, Ky.—This county has voted in favor of issuing court house bonds to the amount of $40,000.

Paducah, Ky.—A $40,000 bond issue has been voted for the erection of a new court house.

Shelbyville, Ky.—The election here result-

ed in favor of issuing court house bonds to the amount of $75,000.

Billings, Mont.—The election here resulted in favor of issuing jail bonds to the amount of $50,000.

Omaha, Neb.—The election here resulted in favor of issuing fire house bonds to the amount of $100,000. Thomas J. Flynn, city clerk.

Stanley, N. D.—The election of Nov. 5 resulted, by a vote of 834 to 770, in favor of issuing court house bonds to the amount of $50,000. W. C. Gibb, county auditor.

Cincinnati, O.—A bond issue of $90,000 has been voted for a new city hall at Norwood.

Cleveland, O.—The expenditure of $50,000 for the erection of comfort stations at street intersections has been authorized.

Cleveland, O.—A $2,000,000 bond issue for a new public library has been voted.

Dunkirk, O.—Dunkirk to-day voted approval of a $15,000 bond issue for an auditorium.

Springfield, O.—A $250,000 bond issue for the construction of a county memorial hall and a public auditorium has been voted. Memorial hall commission.

Pittsburg, Pa.—Bond issues for the following buildings have been voted: City home improvement, $840,000; market house, $300,000; comfort station, $90,000; hospital improvement, $90,000.

Horkville, S. C.—The election here resulted in favor of issuing 4½ per cent. 20-year court house bonds to the amount of $75,000.

FIRE APPARATUS.

BIDS REQUESTED.

Defiance, Ia.—Jan. 1. Furnishing hose cart and fire hose. Town council.

CONTEMPLATED WORK.

Taft, Cal.—Fire apparatus bonds to the amount of $16,000 have been voted.

Lakewood, O.—An $8,500 fire apparatus bond issue has been voted. B. M. Cook, city auditor.

Dallas, Tex.—The purchase of 2,000 feet of Paragon fire hose, at $1.10 per foot, 1,000 feet of Adamant fire hose at 90 cents per foot and 1,000 feet of Overall fire hose at $1 per foot, has been approved by the commissioners.

STREET SIGNS.

CONTEMPLATED WORK.

Lockport, Ill.—An ordinance has been passed providing for the placing of street signs at all corners of the city streets.

PARKS.

CONTEMPLATED WORK.

Gary, Ind.—A 20-acre school park for Tolleston at Fifteenth avenue and Taft street is being planned.

Buffalo, N. Y.—A $994,000 bond issue to acquire lands for dock and park purposes has been authorized.

Toledo, O.—The purchase of property for parks and playgrounds has been authorized. John N. Babcock, clerk of council.

Zanesville, O.—City council has authorized the setting aside of "Water Works Hill," a tract lying between Harvey street, on the south, Main street, on the north, and lying east of Ninth street, for park purposes. P. A. Carb, president of council.

Bartlesville, Okla.—The election here resulted in favor of issuing park bonds to the amount of $25,000.

Pittsburg, Pa.—An addition of 15 acres to Lincoln Park, in the early spring, is contemplated.

AUTOMOBILES AND MOTOR EQUIPMENT.

CONTEMPLATED WORK.

Louisville, Ky.—The purchase of a modern auto truck to replace the hook and ladder apparatus of the fire department has been decided upon by the board of public safety.

Louisville, Ky.—The board of public works will purchase a five-ton truck in the near future. This vehicle will be used for the hauling of broken rocks and bricks to be used in making streets.

Elmira, N. Y.—This city has decided to buy a motor hook and ladder truck. The machine will cost $6,000 and will be equipped with a 70-horse-power engine.

New York, N. Y.—The expenditure of $210,000 for motor trucks, to be used for the removal of refuse, and also of $200,000 to purchase motor equipped street sweeping machines, is contemplated.

Cincinnati, O.—A $5,000 bond issue for purchasing a police telephone system and auto patrol has been provided for by the city council. Fire Chief Burkhardt.

Cleveland, O.—Automobile tractors of a type which will permit attachment to a steamer truck or hose wagon may be purchased for the fire department with the $7,000 recently authorized by council. Safety Director Stage.

McKeesport, Pa.—The city is contemplating the purchase of an auto patrol. David Rosenberg; police committee.

New Brighton, Pa.—The purchase of a $4,500 machine for use by the fire department is contemplated.